

**UNITED STATES DEPARTMENT OF AGRICULTURE
ANIMAL AND PLANT HEALTH INSPECTION SERVICE
WILDLIFE SERVICES**

ENVIRONMENTAL ASSESSMENT

for the

**Management of conflicts associated with non-migratory (resident) Canada geese, migratory
Canada geese, and urban/suburban ducks in the Commonwealth of Virginia.**

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1.0 INTRODUCTION

1.1 PURPOSE OF THE ENVIRONMENTAL ASSESSMENT

The United States Department of Agriculture (USDA) is authorized and directed by law to protect American agriculture and other resources from damage associated with wildlife. The primary statutory authority for the Wildlife Services (WS) program is the Animal Damage Control Act of March 2, 1931, as amended (7 U.S.C. 426-426c; 46 Stat. 1468) and the Rural Development, Agriculture, and Related Agencies Appropriations Act of 1988 (P.L. 100-202). WS activities are conducted in cooperation with other federal, state and local agencies; and private organizations and individuals. Federal agencies, including the United States Department of Interior, Fish and Wildlife Service, recognize the expertise of WS to address wildlife damage issues related to migratory birds.

Wildlife damage management, or control, is defined as the alleviation of damage or other problems caused by or related to the presence of wildlife. It is an integral component of wildlife management (Leopold 1933, the Wildlife Society 1990, Berryman 1991). The WS program uses an Integrated Wildlife Damage Management (IWDM) approach (sometimes referred to as Integrated Pest Management or IPM) in which a combination of methods may be used or recommended to reduce wildlife damage. IWDM is described in Chapter 1, 1-7 of The Animal Damage Control Program Final Environmental Impact Statement (U.S. Dept. Agri. 1994). These methods include the alteration of cultural practices as well as habitat and behavioral modification to prevent damage. The control of wildlife damage may also require that the offending animal(s) be removed or that populations of the offending species be reduced through lethal methods.

WS proposes to conduct a program in the Commonwealth of Virginia in which an IWDM approach will be employed to manage conflicts associated with resident Canada geese, migratory Canada geese, and urban ducks (see Sections 1.2 and 5.4 for a summary and a detailed description of the proposed action). This environmental assessment (EA) documents the analysis of the potential environmental effects of the proposed program. This analysis relies mainly on existing data contained in published documents, primarily the Animal Damage Control Final Environmental Impact Statement (U.S. Dept. Agri. 1994) to which this EA is tiered. Normally, according to Animal and Plant Health Inspection Service (APHIS) procedures implementing the National Environmental Policy Act (NEPA), individual wildlife damage management actions may be categorically excluded from the requirement to prepare an environmental assessment (EA) (7 CFR 372.5(c), 60 Fed Reg. 6,000-6,003, 1995). WS has decided in this case to prepare this EA to facilitate planning, interagency coordination, and the streamlining of program management, and to clearly communicate with the public the analysis of cumulative impacts. These WS activities will be undertaken in compliance with relevant laws, regulations, policies, orders, and procedures including the Endangered Species Act.

A Notice of Availability of the draft environmental assessment was published consistent with APHIS NEPA procedures to allow interested parties the opportunity to obtain and review the document and comment on the proposed management activities. WS had two 30-day comment periods on the draft EA for this Commonwealth of Virginia Canada goose and urban duck program. The first 30-day comment period was announced in 4 regional newspapers on September 1, 1998. The second 30-day comment period was announced in the Federal Register on October 14, 1998. From the two comment periods, WS received 302 comments including 2 from state agencies, 9 from private organizations, 1 from a business, 163 from children at one school, and 127 from private citizens. WS has addressed in this EA the various concerns and issues raised by those comments.

1.2 SUMMARY OF PROPOSED ACTION

WS proposes to conduct a program in the Commonwealth of Virginia in which an IWDM approach will be employed to manage conflicts associated with resident Canada geese, migratory Canada geese, and urban ducks. Human-goose conflicts occur so frequently in Virginia since 1992 that these conflicts are the first or second most common request for assistance among all wildlife species. Urban duck conflicts are difficult for the public to solve because specialized equipment or registered sedatives are needed to solve some urban ducks conflicts. Moreover,

these human-Canada goose and urban ducks conflicts are statewide. Wildlife damage management activities will be conducted on any property in Virginia when the resource owners (property owners) or manager requests assistance with alleviating damage involving resident Canada geese, migratory Canada geese, and urban ducks. Damage will be alleviated using the wildlife damage management approach in which habitat alteration, wire grids, fencing, guarding animals, pyrotechnics, reflective tape, repellents, population reduction, and other methods (Appendix I) could be employed in various combinations to resolve damage problems. Assistance will be provided to the public to protect human health and safety at airports, in the food supply, from potential diseases at recreational sites, in drinking water, at schools, from geese biting people and beating people with their wings during nesting and brood rearing, and in high vehicle traffic areas; to protect property from excessive grazing of turf and accumulations of fecal droppings; to protect agriculture from excessive grazing of small grain and other crops, pulling up of corn, soybean, and other plant sprouts, excessive grazing of pastures used by livestock and alfalfa and hay meadows, threats to animal health from contaminated water, and threats to poultry from airborne pathogens; and to protect natural resources from non-point source pollution and erosion of soils.

1.3 AUTHORITY AND COMPLIANCE

1.3.1 Authority of Federal and State Agencies in wildlife damage management in Virginia

1.3.1.1 Wildlife Services Legislative Mandate

The primary statutory authority for the Wildlife Service program is the Animal Damage Control Act of 1931, which provides that:

"The Secretary of Agriculture is authorized and directed to conduct such investigations, experiments, and tests as he may deem necessary in order to determine, demonstrate, and promulgate the best methods of eradication, suppression, or bringing under control on national forests and other areas of the public domain as well as on State, Territory or privately owned lands of mountain lions, wolves, coyotes, bobcats, prairie dogs, gophers, ground squirrels, jackrabbits, brown tree snakes and other animals injurious to agriculture, horticulture, forestry, animal husbandry, wild game animals, furbearing animals and birds, and for the protection of stock and other domestic animals through the suppression of rabies and tularemia in predatory or other wild animals; and to conduct campaigns for the destruction or control of such animals. Provided that in carrying out the provisions of this Section, the Secretary of Agriculture may cooperate with States, individuals, and public and private agencies, organizations, and institutions."

Since 1931, with the changes in societal values, WS policies and its programs place greater emphasis on the part of the Act discussing "bringing (damage) under control", rather than "eradication" and "suppression" of wildlife populations. In 1988, Congress strengthened the legislative mandate of WS with the Rural Development, Agriculture, and Related Agencies Appropriations Act. This Act states, in part:

"That hereafter, the Secretary of Agriculture is authorized, except for urban rodent control, to conduct activities and to enter into agreements with States, local jurisdictions, individuals, and public and private agencies, organizations, and institutions in the control of nuisance mammals and birds and those mammals and birds species that are reservoirs for zoonotic diseases, and to deposit any money collected under any such agreement into the appropriation accounts that incur the costs to be available immediately and to remain available until expended for Animal Damage Control activities."

1.3.1.2 U.S. Department of Interior, Fish and Wildlife Service Legislative Mandate

The Fish and Wildlife Service's (FWS) authority for action is based on the Migratory Bird Treaty Act of 1918 (as amended), which implements treaties with Great Britain (for Canada), the United Mexican States, Japan, and the Soviet Union. Section 3 of this Act authorized the Secretary of Agriculture:

"From time to time, having due regard to the zones of temperature and distribution, abundance, economic value, breeding habits, and times and lines of migratory flight of such birds, to determine when, to what extent, if at all, and by what means, it is compatible with the terms of the convention to allow hunting, taking, capture, killing, possession, sale, purchase, shipment, transportation, carriage, or export of any such bird, or any part, nest, or egg thereof, and to adopt suitable regulations permitting and governing the same, in accordance with such determinations, which regulations shall become effective when approved by the President".

The authority of the Secretary of Agriculture with respect to the Migratory Bird Treaty was transferred to the Secretary of the Interior in 1939 pursuant to Reorganization Plan No. II, Section 4(f), 4 Fed. Reg. 2731, 53 Stat. 1433.

1.3.1.3 Virginia Department of Game and Inland Fisheries Legislative Mandate

The Virginia Department of Game and Inland Fisheries (VDGIF), under the direction of the Governor-appointed Board of Directors, is specifically charged by the General Assembly with the management of the state's wildlife resources. Although many legal mandates of the Board and the Department are expressed throughout the Code of Virginia, the primary statutory authorities include wildlife management responsibilities (29.1-103), public education charges (29.1-109), law enforcement authorities (29.1-109), and regulatory powers (29.1-501). In 1990, the Board of Directors adopted mission statements to help clarify and interpret the role of VDGIF in managing the wildlife resources of Virginia. They are:

To manage Virginia's wildlife and inland fisheries to maintain optimum populations of all species to serve the needs of the Commonwealth;

To provide opportunity for all to enjoy wildlife, inland fisheries, boating and related outdoor recreation; and

To promote safety for persons and property in connection with boating, hunting, and fishing.

VDGIF currently has a Memorandum of Understanding (MOU) with WS. This document establishes a cooperative relationship between WS and VDGIF, outlines responsibilities, and sets forth annual objectives and goals of each agency for resolving wildlife damage management conflicts in Virginia.

1.3.1.4 Virginia Department of Agriculture and Consumer Services Legislative Mandate

Virginia Department of Agriculture and Consumer Services (VDACS) has the statutory authority to manage damage to agriculture and property, and to protect human health and safety from damage involving birds (Title 3.1 - 1011). VDACS currently has a MOU with WS which establishes a cooperative relationship between WS and VDACS, outlines responsibilities, and sets forth annual objectives and goals of each agency for resolving wildlife damage management conflicts in Virginia.

1.3.2 Compliance with Other Federal and State Statutes

Several federal laws, state laws, and state regulations regulate WS wildlife damage management. WS complies with these laws and regulations, and consults and cooperates with other agencies as appropriate.

National Environmental Policy Act. Environmental documents pursuant to NEPA must be completed before work plans consistent with the NEPA decision can be implemented. WS also coordinates specific projects and programs with other agencies. The purpose of these contacts is to coordinate any wildlife damage management that may affect resources managed by these agencies or affect other areas of mutual concern.

Endangered Species Act (ESA). It is federal policy, under the ESA, that all federal agencies shall seek to conserve endangered and threatened species and shall utilize their authorities in furtherance of the purposes of the Act (Sec. 2(c)). WS conducts Section 7 consultations with the FWS to use the expertise of the FWS to ensure that "any action authorized, funded or carried out by such an agency. . . is not likely to jeopardize the continued existence of any endangered or threatened species. . . Each agency shall use the best scientific and commercial data available" (Sec. 7(a)(2)).

Migratory Bird Treaty Act (MBTA). The MBTA provides the FWS regulatory authority to protect species of birds that migrate outside the United States. The law prohibits any "take" of the species, except as permitted by the FWS or by federal agencies within the scope of their authority; therefore the FWS issues permits for managing wildlife damage situations. However, the MBTA permit requirements do not apply to Federal agencies. Additionally, WS actions are consistent with what is allowed under 50 Code of Federal Regulations, Part 21, developed by the FWS. Also, if state agencies are to assist WS in taking migratory birds then those state agencies are required by MBTA to have a permit.

Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA). FIFRA requires the registration, classification, and regulation of all pesticides used in the United States. The Environmental Protection Agency (EPA) is responsible for implementing and enforcing FIFRA. All chemical methods integrated into the WS program in Virginia are registered with and regulated by the EPA and VDACS, and used by WS in compliance with labeling procedures and requirements.

Investigational New Animal Drug. The Food and Drug Administration (FDA) grants permission to use investigational new animal drugs (21 Code of Federal Regulations [CFR], Part 511). Alpha chloralose is now classified as an animal drug (21 CFR 510) and cannot be purchased from any source except WS. The FDA authorization allows WS to use alpha chloralose to capture geese, ducks, coots, and pigeons. FDA acceptance of additional data will allow WS to consider requesting an expansion in the use of alpha chloralose for more species.

Virginia Nuisance Bird Law. This Act allows the Commissioner of Agriculture for VDACS to conduct surveys and investigations of economic loss or public nuisances caused by birds. The Commissioner may then develop a plan of action when birds are causing economic loss or are detrimental to the health and welfare of the public, or create a public nuisance. This Act also allows the Commissioner to provide technical assistance for the suppression of nuisance birds. This Act allows the Commissioner to cooperate with federal and state agencies, other public and private agencies, organizations, institutions, and persons.

Possession, Transportation, and Release of Wildlife by Authorized Persons. This regulation (4 VAC 15-30-50) authorizes employees of federal wildlife management agencies and local animal control officers in the performance of their duties to take problem wildlife in the Commonwealth of Virginia. According to VDGIF, permits to take migratory birds are issued by the FWS and not VDGIF, therefore no state permit is required of WS to take migratory birds in Virginia.

1.4 RELATIONSHIP TO OTHER ENVIRONMENTAL DOCUMENTS

- 1.4.1 ADC Programmatic EIS.** WS (formerly known as Animal Damage Control[ADC]) has issued a Final EIS on the national APHIS/WS program (USDA 1994). Pertinent and current information available in the Final EIS has been incorporated by reference into this EA.
- 1.4.2. Environmental Assessment: Permits for the control and management of injurious resident Canada geese.** The USDI - FWS proposes, in cooperation with State wildlife agencies, to establish a resident Canada goose damage management program. This program is designed to provide a biologically sound and more cost effective and efficient method for the control of locally-breeding (resident) Canada geese that pose a threat to health and human safety and are responsible for damage to personal and public property.

An environmental assessment for that program was prepared by the FWS in February 1998. Additionally, the proposed rule "Migratory Bird Special Canada Goose Permit" was published in the Federal Register, (15698 - 156705) on March 31, 1998. The FWS is currently preparing a final rule on the program. The FWS justification for this permit is ... "These increasing populations of locally-breeding geese are resulting in increasing numbers of conflicts with human activities, and concerns related to human health and safety are increasing...". Moreover, this proposed WS program and the FWS permit procedures have similar justification and proposed action (e.g., use of applicable non-lethal methods, time period geese may be taken, donation of geese to charity, methods of take for geese).

2.0 NEED FOR ACTION

The WS Program in Virginia received approximately 3,045 requests for wildlife damage management assistance from the public during federal fiscal years 1992 through 1997 (October 1, 1991 to September 30, 1997). Conflicts between humans and wildlife are common in the Commonwealth of Virginia. Canada geese damage management requests ranked as the first or second most common type of request for wildlife damage management assistance received by WS during this period. During this period, 623 requests for technical assistance with Canada goose damage were received from the public. Requests for wildlife damage management assistance with urban/suburban duck damage were also received from the public during this time period. The vast majority of Canada goose damage complaints involved non-migratory (resident) Canada geese. This document addresses the need for WS assistance in responding to requests for resident Canada goose, migratory Canada goose, and urban/suburban duck management services.

2.1 RESIDENT CANADA GOOSE CONFLICTS

Resident Canada geese refer to primarily local breeding Canada geese which nest and raise their young in Virginia (Costanzo 1993). Resident Canada geese do not migrate to northern Canada but remain in Virginia year-round (Costanzo 1993). Canada geese are classified as migratory birds and are managed under the MBTA. Damage and threats to human health or safety from resident Canada geese occurs statewide in Virginia (Fig. 1). Resident Canada goose damage/conflicts affect numerous resources in Virginia including public and personal property, human health and safety, agriculture, and natural resources (Table 1). The more common problems involving resident Canada geese in Virginia are damage to property (turf, golf greens, and gardens) from excessive grazing and accumulations of large quantities of fecal droppings on recreational properties (beaches, parks, golf courses, ball fields) which cause health concerns and a feeling of being denied use of the property because of the filth from excessive quantities of goose feces; damage to agricultural crops (cereal grains, peanuts, soybeans, and corn) and pastures from excessive grazing by resident Canada geese; and threats to aviation since geese are found at most airports and military bases in Virginia.

2.1.1 Property damage involving resident Canada geese

Property damage most often involves goose fecal matter that pollute and contaminate landscaping and walkways, often at golf courses and water front property. Damage can also occur when geese graze grasses excessively and feed by burrowing grass plugs from golf greens in summer. For example, a subdivision on the James River near Hopewell in Prince George County sustained a reported \$40,000 in damage to turf from excessive grazing by 100 resident Canada geese in July 1994. Businesses are also concerned about the negative aesthetic appearance of their property caused by excessive droppings and excessive grazing, and are sensitive to comments by clients and guests. Costs associated with property damage include labor and disinfectants to clean and sanitize fecal droppings, implementation of nonlethal wildlife management methods, loss of property use, loss of aesthetic value of flowers, gardens, and lawns consumed by geese, loss of customers or visitors irritated by walking in or breathing the fumes of fecal droppings, repair of golf greens, replacing grazed turf, and loss of time contacting local health departments and wildlife management agencies on health and safety issues.

2.1.2 Threats to human health or safety involving resident Canada geese

Resident Canada goose conflicts negatively impact human health and safety in several ways which are discussed in the following sections.

2.1.2.1 Threats from pathogens

Waterfowl can threaten human health through fecal matter when contaminated water or fecal droppings are ingested

or by inhalation of causative organisms. There are several pathogens involving waterfowl which may be contracted by humans, however, the risk of infection is believed low.

Escherichia coli (E. coli) are fecal coliform bacteria associated with fecal material of warm blooded animals. There are over 200 specific serological types of E. coli and the majority are harmless (Sterritt and Lester 1988). Probably the best known serological type of E. coli is E. coli O157:H7, which is a harmful E. coli usually associated with cattle (Gallien and Hartung 1994). The presence of E. coli in water indicates contamination by fecal material and possibly with excreted pathogens (Feachem et al. 1983). This was the rationale for testing public water supplies that was developed in the United States and Europe at the turn of the century to reduce the incidence of waterborne diseases. E. coli can contaminate swimming areas resulting in closure by health officials (Jamieson 1998, Samadpour 1998) and contaminate drinking water resulting in remedial actions (Werblow 1997, Klett et al. 1998). Resident Canada geese also create a disease threat (i.e., coliform bacteria) to bathers using beaches, ponds, and lakes where excessive numbers of geese defecate fecal material (Anderson 1998). Commonly adopted standards in the United States set indicator bacterial standards for drinking water at less than 20 fecal coliforms per 100 milliliters (Sterritt and Lester 1988) (Total Coliform Rule of the Safe Drinking Water Act [40 CFR 141.21]), for body contact recreational waters (swimming) at 200 fecal coliforms per 100 milliliters (Feachem et al. 1983, 9 VAC 25-260-170), and for fishing and boating at less than 1000 fecal coliforms per 100 milliliters. In all surface waters in Virginia state law mandates that the fecal coliform bacteria count shall not exceed 200 fecal coliform bacteria per 100 ml of water (9 VAC 25-260-170). A Bath County homeowner near the Virginia Power Pump Storage Reservoir had 100 Canada geese using his manmade spring-fed pond which serves as his drinking water supply in September 1998. He was concerned the geese were contaminating his drinking water and threatening his family's health.

Cryptosporidiosis is a disease caused by the parasite *Cryptosporidium parvum* and was not known to cause disease in humans until as late as 1976 (Centers for Disease Control and Prevention 1995). Over 400,000 people in Milwaukee, Wisconsin during 1993 became ill with diarrhea from drinking water contaminated with *Cryptosporidium* spp. (Centers for Disease Control and Prevention 1995). The oocyst of this protozoan is highly resistant to chlorination (Colley 1996, Virginia Department of Health 1995). A person can be infected by drinking contaminated water or direct contact with the droppings of infected animals (Centers for Disease Control and Prevention 1995). The public is advised to be careful when swimming in lakes, ponds, streams, and pools, and to avoid swallowing water while swimming (Colley 1996). The public is also advised to avoid touching stools of animals and to drink only safe water (Colley 1996). *Cryptosporidium* can cause gastrointestinal disorders (Virginia Department of Health 1995) and produce life-threatening infections in immunocompromised and immunosuppressed people (Virginia Department of Health 1995, Graczyk et al. 1998). *Cryptosporidium* is considered a significant public health threat from the feces of Canada geese (L. Jargowsky, Monmouth County Board of Health, letter to J. Bucknall, USDA-APHIS-Wildlife Services, December 18, 1998). Cryptosporidiosis is recognized as a disease with implications for human health (Smith et al. 1997). Canada geese in Maryland were shown with molecular techniques to disseminate infectious *Cryptosporidium parvum* oocysts in the environment (Graczyk et al. 1998).

Giardiasis is an illness caused by a microscopic parasite (Centers for Disease Control and Prevention 1998). During the last 15 years, *Giardia lamblia* has become recognized as one of the most common causes of waterborne disease in humans in the United States (Centers for Disease Control and Prevention 1998). Several community wide outbreaks of Giardiasis have been linked to drinking municipal water contaminated with *Giardia* (Centers for Disease Control and Prevention 1998). Giardiasis causes diarrhea, cramps, and nausea (Centers for Disease Control and Prevention 1998). Giardiasis is contracted by swallowing contaminated water or putting anything in your mouth that has touched the stool of an infected animal or person (Centers for Disease Control and Prevention 1998). *Giardia* sp. oocysts were present in the feces of Canada geese in Maryland (Graczyk et al. 1998) and may have serious implications for the contamination of watersheds (Upcroft et al. 1997, cited from Graczyk et al. 1998, Davidson and Nettles 1997, Smith et al. 1997). The Virginia WS program has been contacted by the public inquiring if they could get giardiasis from ducks and geese.

Salmonella can be contracted by humans by handling materials soiled with bird feces (Stroud and Friend 1987) or through contact with goose feces (E. Myers, Thomas Jefferson Health District, letter to M. Columbus, Little Keswick School, August 19, 1993). Salmonella causes gastrointestinal illness, including diarrhea, from swimming in infected waters. The Virginia WS program has been contacted by the public inquiring about the potential to contract salmonella from ducks and geese.

Chlamydia psittaci, which is present in diarrhetic feces of infected waterfowl, can become airborne and this is one route of infection (Locke 1987). Severe cases of Chlamydiosis have occurred among wildlife biologists handling snow geese, ducks, and other birds (Wobeser and Brand 1982). Chlamydiosis can be fatal to humans if not treated with antibiotics. Also, Chlamydia can be mis-diagnosed as flu, so physicians should be informed if people suspected of chlamydiosis infection have been around large numbers of birds and fecal droppings. Waterfowl, herons, and rock doves (pigeons) are the most commonly infected wild birds in North America (Locke 1987). Infection of chlamydiosis is usually thought of in association with pet birds, domestic pigeons or poultry, but there have been a number of recorded instances involving wild birds (Wobeser and Brand 1982). The Virginia WS program has been contacted by the public inquiring about the possibility of contracting a disease by inhaling pathogens from excessive quantities of fecal droppings.

There have been many cases of *Mycobacterium avium*, or avian tuberculosis being transmitted to people (Roffe 1987). Most humans are considered highly resistant to avian tuberculosis except those with pre-existing diseases of the lungs or whose immune systems are impaired (Roffe 1987).

Table 1. Number of incidents by resource category involving Canada geese damage reported to the USDA-APHIS-Wildlife Services Program (WS) from April 1992 through June 1997 to Virginia Department of Agriculture and Consumer Services (VDACS) from January 1992 through June 1997, and to Game and Inland Fisheries (VDGIF) from January 1992 through June 1996.

Resource Category	Resource Subcategory	Number of Incidents		
		Reported to WS	Reported to VDACS ₁	Reported to VDGIF ₁
Property	Animal	4		
	Equipment	5		
	Landscaping	510		
	Structures	8		
	Other	3	1,037	250
Agriculture	Aquaculture	3		
	Field crops	44		40
	Livestock	15		5
	Range/pasture	18		
	Other	3	158	
Human health and safety	Human	260	54	10
	Aviation	30		
Natural Resources	Other	8	-	25
TOTAL		913	1,249	330

1. VDGIF and VDACS track damage data by Resource Category only.

2.1.2.2 Threats in Virginia

Parents and school officials are very concerned about children handling, walking in, or being exposed to excessive quantities of fecal droppings from resident Canada geese or urban ducks. For example, Little Keswick School, a school for mentally retarded and learning disabled children was advised by the Thomas Jefferson Health District in 1993 to remove the Canada geese from the school grounds to protect the welfare of the children (E. Myers, Thomas Jefferson Health District, letter to M. Columbus, Little Keswick School. August 19, 1993).

Local health departments occasionally issue a "Health Advisory" to warn citizens of disease-causing organisms which may affect human health. On August 21, 1998, The Franklin County Health Department of the West Piedmont Health District issued a health advisory because of unacceptably high levels of fecal coliform bacteria believed caused by waterfowl at Bay Roo Marina at Hardy Ford Bridge, a cove at Crazy Horse Campground, and Becky's Creek. It was recommended the public not swim or water ski in these areas of Smith Mountain Lake.

2.1.2.3 Linking waterfowl to human health threats

The FWS in Region 5 had been requesting evidence linking waterfowl to threats to human health as a requisite to issuing a federal permit to kill waterfowl outside of the traditional regulated hunting seasons. Attributing human pathogens to waterfowl has been problematic until recently. Microbiologists were able to implicate waterfowl and gulls as the source of fecal coliform bacteria at the Kensico Watershed, a water supply for New York City (Klett et al. 1998). Also, fecal coliform bacteria counts coincided with the number of Canada geese and gulls roosting at the reservoir.

Recent advances in genetic engineering have allowed microbiologists to match genetic code of coliform bacteria to specific animal species and link these animal sources of coliform bacteria to fecal contamination (Anonymous, 1998, Jamison 1998, Samadpour 1998, Simmons et al. 1995). Fecal coliform bacteria from waterfowl, Canada geese in particular, have been linked to fecal contamination in Lake Washington near Seattle, Juanita Beach in Kirkland, Washington, and Deep Creek Lake in Montgomery County, Pennsylvania (Anonymous, 1998, Jamison 1998, Samadpour 1998, Werblow 1997). Simmons et al. (1995) used genetic fingerprinting to link fecal contamination of small ponds on Fisherman Island, Virginia to waterfowl. Simmons et al. (1998) concluded in order to see a bird fecal coliform signature there must be many birds crowded into a small area and no flushing or diluting effects due to tidal action. Jamison (1998) reported that county park workers at Juanita Beach are exploring ways to flush Canada goose droppings which would be expected to lower fecal coliform bacteria. The lack of flushing at Juanita Beach coincides with Simmons et al. (1995) conclusion that a lack of tidal flushing is necessary to see a bird fecal coliform signature.

2.1.2.4 Water-borne disease outbreaks are under reported and unrecognized

Kramer et al. (1996) considered surveillance data of water systems useful for providing safe drinking water and recreational water. However, Kramer et al. (1996) more importantly stated that surveillance data do not reflect all water-borne disease outbreaks (WBDOs) because these outbreaks may not be recognized, investigated, or reported to the Center for Disease Control (CDC) or the EPA. According to the Virginia Department of Health, no surveillance or testing is being done to look at the threat waterfowl may pose to human health, therefore the health problem is unknown (E. Barrett and M. Monti, VA Dept. Of Health, pers. commun.). Kramer et al.'s (1996) point on surveillance data not reflecting all WBDOs because of lack of recognition, investigation, or reporting is illustrated in the Cardinal Road subdivision of Huddleston, VA incident (see 2.3.1 Threats to human health of safety from ducks). The residents contacted the Bedford County Health Department for assistance which was unable to test the water in the cove or the ducks because the Bedford County Health Department's jurisdiction ended at the shoreline. The residents then contacted the Virginia Department of Environmental Quality (DEQ) for assistance and they were informed that DEQ does not test for biological contaminants to determine the cause of disease. The Regional Department of Health requested the Cardinal Road residents send medical reports and diagnosis for evaluation. A

follow up meeting with Virginia Department of Health officials in September 1998 indicated state officials were unaware of this possible WDBO involving waterfowl.

While the public may be concerned about disease transmission from fecal droppings, the probability of contracting disease from fecal droppings is believed to be small.

2.1.2.5 Threats to Aviation

Waterfowl (geese and ducks) comprise 12% of all bird-aircraft strikes and 16% of bird-aircraft strikes where civil aircraft were damaged (Cleary et al. 1997). No other bird species cause as many damaging bird-aircraft strikes as waterfowl, except gulls which also cause 16% of damaging bird-aircraft strikes (Cleary et al. 1997). For example, three Canada goose - aircraft strikes at airports near New York City resulted in over \$15 million dollars in damage during 1995 (National Wildlife Research Center, Research Update, 1998). On September 14, 1995 a 757 aircraft struck 10 Canada geese at Dulles International Airport causing \$1.7 million dollars in damage to the radome, both engines, and both wings (D. Pitts, Dulles International Airport, pers. commun.). On October 6, 1998, 10 Canada geese struck a C12 Gulfstream twin engine propeller plane at Fort Belvoir causing \$300,000 dollars in damage to one engine (M. Hudson, Fort Belvoir, pers. commun.).

Canada geese are one of the more dangerous bird species for aircraft to strike because of their large size (8 - 12 pounds) and because they travel in flocks of up to several hundred birds. Resident Canada geese presence on and around airports creates a threat to aviation and human safety. There is a very strong relationship between bird weight and the probability of plane damage (Anonymous 1992). For example, there is a 90% probability of plane damage when the bird weighs 70 or more ounces (4 1/3 pounds) versus a 50% probability of plane damage for a 6 ounce (1/3 pound) bird (Anonymous 1992).

Resident Canada geese have been involved in aircraft strikes in Virginia at Dulles International Airport, Ronald Reagan National Airport, Norfolk International Airport, Roanoke Regional Airport, and Fort Belvoir. Some of these Canada goose - aircraft strikes resulted in costly plane repairs, and aborted take-offs and landings. Military bases in Virginia have grave concern about Canada geese on airfields since a Canada goose - aircraft strike at Elmendorf Air Force Base in 1995 resulted in the death of 24 Air Force personnel because the plane ingested Canada geese into two engines and crashed on takeoff. Langley Air Force Base and Norfolk Naval Air Station have altered, delayed, aborted, and ceased flight operations because of Canada geese on their air field.

2.1.2.6 Other threats to human health

Resident Canada geese have also acted aggressively toward small children during nesting and brood rearing, resulting in children being bitten and beaten with wings. A four-year old child was assaulted by a pair of Canada geese when he walked out a door and stepped between the adult geese and goslings at the Radisson Hotel in Alexandria, Virginia in 1994 (T. Crowley, Radisson Hotel, pers. commun.) There were additional goose-children interactions in 1993 when children were bitten or struck by Canada geese at the Radisson Hotel. In some of these encounters the children taunted or were feeding the geese when attacked (T. Crowley, Radisson Hotel, pers. commun.).

The Public Health Service activities in the area of milk sanitation began at the turn of the century with studies on the role of milk in the spread of disease. These studies led to the conclusion that effective public health control of milk borne disease requires the application of sanitation measures throughout the production, handling, pasteurization, and distribution of milk. The 1995 *Grade A Pasturized Milk Ordinance* recommended by the United States Public Health Service and the Food and Drug Administration is used as the sanitary regulation for milk and milk products. The Milk Ordinance says "Cows should not have access to piles of manure, in order to avoid the soiling of udders and the spread of diseases among cattle" and it also says manure may not accumulate so as to permit the soiling of udders. Virginia regulation 2 VAC 5-490-50 requires fowl be kept out of the milking barn, stable, and parlor as well as the cow yard, loafing, and housing area. The VDACS has three concerns about Canada geese being in the

yard with dairy cattle: 1) accumulation of goose feces which cattle could lay in and contaminate the udder with pathogens, 2) denuding of ground cover in the yard resulting in muddy conditions and difficulty keeping udders sanitary, and 3) contamination of feed bunks with goose feces (J. Beers, VDACS, pers. commun.). The VDACS, Office of Dairy and Foods says birds can not be in the yard because of the possible spread of salmonella and other diseases through direct contact of udders with bird feces (J. Beers, VDACS, pers. commun.). Raw milk could become contaminated during the milking process because of pathogens on the udder (J. Beers, VDACS, pers. commun., W. J. Farley, VDACS, letter to J. Beers, VDACS, January 29, 1999). A dairy farm in Rockingham County, Virginia was investigated in January 1999 by the VDACS, Bureau of Dairy Services, because it had up to 600 Canada geese feed on waste grain and loaf in the yard among dairy cattle. VDACS instructed the farmer to correct the problem to comply with the Virginia regulation (W. J. Farley, VDACS, letter to J. Beers, VDACS, January 29, 1999).

Additionally, traffic hazards are created when resident Canada geese walk across streets and other roadways and cars swerve or brake to avoid hitting the birds only to strike another vehicle or property. Associated costs with human health and safety threats involving resident Canada geese would include testing of water for coliform bacteria, cleaning and sanitizing beaches regularly of fecal droppings, contacting and obtaining assistance from public health officials, implementing non-lethal wildlife management methods, missing connecting flights or departure and arrival times, children developing fear of resident Canada geese, and personal injuries and vehicle repairs.

2.1.3 Resident Canada goose damage to agriculture

Canada geese have been reported causing damage to crops and livestock in several ways which are discussed in the following sections.

2.1.3.1 Damage to crops

Agricultural resources damaged by resident Canada geese include direct damage to grain crops. Grazing of pastures and alfalfa meadows deprive livestock of food and causes an increased economic hardship on livestock producers. Resident Canada geese have grazed a variety of crops in Virginia: barley, corn, soybeans, wheat, rye, oats, and peanuts. Heavy grazing by Canada geese has resulted in reduced yields and in some instances a total loss of the grain crop in Virginia. Allen et al. (1985) showed a single heavy grazing event by Canada geese in late January through February can reduce the yield of winter wheat by 13%. Allen et al. (1985) also showed that winter wheat grazed only from November through January had increased yields. Since 1985, agricultural practices have changed resulting in intensive wheat growing practices with much higher yields of approximately 100 bushels per acre but unable to sustain even light grazing pressure without losing yield. Associated costs with agricultural damage involving resident Canada geese include costs to replant grazed crops (soybeans, corn, peanuts), implement non-lethal wildlife management practices, purchase replacement hay, long distance calls to government agencies to seek assistance, and decreased yields.

2.1.3.2 Damage to livestock

Resident Canada geese are also a concern to livestock producers. Goose droppings in and around livestock ponds can affect water quality and are a source of a number of different types of bacteria. Although no direct links have been made, salmonella outbreaks have occurred in cattle on farms in northern Virginia when large numbers of geese were present. State veterinarians are concerned about the potential disease interactions between Canada geese and cattle. Salmonella causes shedding of the intestinal lining and severe diarrhea in cattle. If undetected and untreated, salmonella can kill cattle and calves.

The transmission of disease through drinking water is one of the primary concerns for a safe water supply for livestock. Bacteria levels for livestock depend on the age of the animal since adults are more tolerant of bacteria

than young animals (Anonymous 1998). The bacteria guidelines for livestock water supplies are <1000 fecal coliforms/100 ml for adult animals and < 1 fecal coliform/100 ml for young animals (Anonymous 1998).

Wild and domestic waterfowl are the acknowledged natural reservoirs for a variety of avian influenza viruses (Davidson and Nettles 1997). Avian influenza circulates among these birds without clinical signs and is not an important mortality factor in wild waterfowl (Davidson and Nettles 1997). However, the potential for avian influenza to produce devastating disease in domestic poultry makes its occurrence in waterfowl an important issue (Davidson and Nettles 1997, USDA-APHIS-Veterinary Services 1993). In 1983 - 1984, the outbreak of avian influenza resulted in the slaughter of 1.7 million domestic turkeys and chickens at a loss of \$63 million in Virginia (Trice 1999a). An outbreak of avian influenza in January 1999 on a Rockingham County farm resulted in the slaughter of 30,000 turkeys (Trice 1999). The Rockingham County farm was near a pond used by waterfowl. While the flock of 30,000 turkeys was being slaughtered, a flock of Canada geese was observed on a pond near the poultry operation (Eggborn, VDACS, pers. commun.). The strain of avian influenza which necessitated killing the 30,000 turkeys was a different strain of the virus which killed 6 people in Hong Kong in 1997 (Trice 1999). Also, a flock of 30,000 game birds, including pheasants, chukars, quail, partridge, wild turkeys, Canada geese, mute swans and assorted chickens in Maryland was most likely infected by ducks which returned to the game farm after co-mingling with wild waterfowl (R. Olson, Maryland Department of Agriculture, Animal Health Program, letter to whom it may concern, December 22, 1998). Farmers are warned to keep poultry away from wild or migratory birds or water contaminated by wild or migratory birds (USDA-APHIS-Veterinary Services 1993).

While Canada geese have been implicated in causing Bovine Coccidiosis in calves, the coccidia which infect cattle is a different species of coccidia than the coccidia which infects Canada geese (Doster 1998). Causes of coccidia in cattle are from other infected cattle (Doster 1998).

Associated costs involving livestock health include veterinary costs, implementation of non-lethal wildlife management practices, and altering husbandry and recreational use of horses so that wildlife management practices (harassment, use of dogs, legal hunting) will not negatively affect horses and threaten the safety of riders. Producers are particularly concerned about the potential for high value pure breed horses and cattle becoming infected and dying.

2.1.4 Resident Canada goose damage to natural resources

Resident Canada geese negatively impact Virginia's natural resources. Excessive numbers of resident Canada geese have affected water quality around beaches and in wetlands by nonpoint source pollution. There are four forms of nonpoint source pollution: sedimentation, nutrients, toxic substances, and pathogens. Excessive numbers of Canada geese can remove shoreline vegetation resulting in erosion of the shoreline and soil sediments being carried by rainwater into lakes, ponds, and reservoirs. Excessive numbers of Canada geese have been reported to be sources of nutrients and pathogens in water. Sewage treatment plants in Virginia are required to test water quality of effluents before release from finishing ponds into the environment. Sewage treatment plants find coliform bacteria counts increase dramatically when large numbers of Canada geese are present and decline dramatically when the geese are removed (A. Pratt, Upper Occoquan Sewage Authority, unpub. data). Coliform bacteria causes acidic pH levels in the water and lowers dissolved oxygen which kills aquatic organisms (Cagle 1998). Also, fecal contamination increases nitrogen levels in the pond resulting in algae blooms. Oxygen levels are depleted when the algae dies resulting in the death of aquatic invertebrates and vertebrates.

Canada geese are attracted to waste water treatment plants because of the water and available grasses. Canada geese can threaten the health of the environment by damaging manmade structures holding waste water which is regulated by the Virginia Department of Environmental Quality (DEQ). Severe grazing of levees results in the removal and loss of turf which hold soil on manmade levees. Heavy rains on bare soil levees results in erosion which would not have occurred if the levee had been vegetated. The Green County Waste Water Treatment Plant was instructed by DEQ to take corrective action in July 1998 because excessive grazing by 200 Canada geese had left the levees vulnerable to washout during heavy rain (A. Koontz, Rapidan Service Authority, pers. commun.).

2.1.5 Where resident Canada goose damage occurs in Virginia

Resident Canada goose complaints have been received from 64 counties and 17 independent cities in Virginia (Fig. 1). The greatest number of calls have come from counties in northern Virginia including Fairfax and Loudoun Counties. The higher densities of resident Canada geese and people in northern Virginia probably contribute to the large number of damage complaints from that region.

Table 2. Number of and counties where Canada geese were captured for relocation by Virginia Department of Agriculture and Consumer Services, 1979-1996.

<u>County</u>	<u>Number captured</u>	<u>Percent of total number captured</u>
Accomack	244	2
Albemarle	1048	11
Bath	4	-
Caroline	14	-
Chesterfield	281	3
Fairfax	2549	26
Fauquier	12	-
Fluvanna	2	-
Frederick	27	-
Goochland	81	1
Greene	324	3
Greensville	69	-
Hanover	159	2
Henrico	104	1
Isle of Wight	330	3
James City	1388	14
King and Queen	94	-
Loudoun	100	1
Madison	56	-
Montgomery	148	2
Nelson	170	2
New Kent	311	3
Norfolk	5	-
Orange	8	-
Powhatan	33	-
Prince George	25	-
Prince William	564	6
Rockingham	35	-
Spotsylvania	348	4
York	486	5
Unknown	825	11
TOTAL	9844	100

The VDACS has previously captured and relocated resident Canada geese to alleviate local damage in Virginia (Table 2). Resident Canada geese have been captured in 30 counties since 1979. Fifty-seven percent of the resident Canada geese have been captured in Fairfax, Albemarle, James City, and Prince William counties. The result of relocation has been the alleviation of damage in one location only to create future damage in another location.

Table 3. Canada goose damage types reported to USDA-APHIS-Wildlife Services in Virginia, April 1992 through June 1997.

<u>Damage type</u>	<u>Number of incidents</u>	<u>Percent of total</u>
fecal droppings	568	62
excessive grazing	196	21
other human health & safety	58	6
aircraft strike or threat	31	3
animal disease or threat of	17	2
damage threat	8	1
nuisance	11	1
consumption/food contamination	7	1
other	17	2
TOTAL	913	99₁

1. Does not equal 100 due to rounding.

Damage caused by Canada geese occurs year round with the majority of the damage occurring February through October, especially June, July, and August. Over 80% of the reports of Canada goose damage involved fecal droppings or excessive grazing (Table 3).

2.2 MIGRATORY CANADA GOOSE CONFLICTS

Migratory Canada geese refer to Canada geese which nest and raise their young in the arctic and sub-arctic regions of Canada. Migratory Canada geese migrate from Virginia in March towards the arctic to nest (G. Costanzo, VDGIF, pers. commun.). Migratory Canada geese begin arriving in Virginia during late September to spend the winter (G. Costanzo, VDGIF, pers. commun.). Migratory subspecies of Canada geese are classified as migratory birds and are managed under the MBTA. Migratory Canada goose damage/conflicts affect few resources in Virginia, mostly agricultural crops and aviation east of Interstate 95. Few migratory Canada geese, estimated at less than 6,000 - 7,000 birds, winter west of Interstate 95 (G. Costanzo, VDGIF, pers. commun.). Damage caused by migratory Canada geese are reported primarily December through early March.

2.2.1 Threats to aviation

Canada geese have been struck by aircraft at airports in Virginia (section 2.1.2.5 Threats to aviation) and it is believed resident Canada geese were involved in those strikes because of the time of year of the strike or resident Canada geese were known to live in the vicinity of the airport. While it is unknown if migratory Canada geese have been involved in aircraft strikes, there is concern by airports and airbases when large numbers of geese fly through

flight paths of departing and approaching civil and military aircraft or when military aircraft fly low level training flights in areas used by numerous Canada geese in eastern Virginia.

2.2.2 Damage to crops

Agricultural resources damaged by migratory Canada geese include grazing grain crops, kale, and spinach. Migratory Canada geese have grazed a variety of grain crops in eastern Virginia including barley, wheat, rye, and oats. Farms suffering the severest grazing damage to crops from migratory Canada geese usually are along large rivers in eastern Virginia or on the eastern shore. The impacts of grazing by Canada geese are described in section 2.1.3.1 Damage to crops. The number of migratory Canada geese reported grazing a single crop field ranged from 350 to 3,000 in 1998-99 (WS, unpublished data). Grazing of pastures by migratory Canada geese has deprived livestock of forage and increased economic hardship on livestock producers. Associated costs with agricultural damage involving migratory Canada geese include costs to implement non-lethal wildlife management practices, purchase replacement hay, long distance calls to government agencies, and decreased yields.

2.2.3 Where migratory Canada goose damage occurs

Migratory Canada goose damage occurs primarily east of Interstate 95, including the eastern shore of Virginia where the geese winter. A few migratory Canada geese winter around and north of Lake Anna in northern Virginia. Reports from farmers and VDGIF indicate the severest damage to grain crops occurs on farms adjacent to large rivers (e.g., Rappahannock, York, Mattaponi, James, Pamunkey) where migratory Canada geese roost by the thousands or on the eastern shore.

2.3 URBAN DUCK CONFLICTS

The term "urban ducks" in this environmental assessment refers to captive-reared, domestic, of some domestic genetic stock, or domesticated ducks and domestic breeds of ducks such as Muscovy and Peking. Urban duck abundance causes conflicts at shopping centers, homeowner associations, apartment complexes, office parks, swimming pools, and with wild ducks. Bellrose (1976) provides a description of a wild mallard duck. Some urban ducks which look similar to wild mallard ducks lack the physical features of a wild mallard duck.

2.3.1 Threats to human health or safety from ducks

Urban ducks negatively impact human health and safety by being vectors of disease and causes of automobile accidents. Many of the same threats to human health (e.g., E. coli, cryptosporidiosis, giardiasis, salmonella, chlamydiosis) described in section 2.1.2.1 Threats from pathogens would be of concern from ducks. Waterfowl are intermediate hosts for swimmers itch (Cercarial dermatitis) which swimmers have contracted by swallowing contaminated water (Hoefiler 1974) in Frederick County, Virginia and the City of Suffolk, Virginia in 1996 (Barrett 1996). Ducks and snails are part of the life cycle for the occurrence of Cercarial dermatitis which affects humans.

Parents are also concerned about their children getting sick from swimming in water contaminated with waterfowl feces. Seven residents of Cardinal Road, Huddleston, VA were diagnosed by their doctors with salmonella and giardia after swimming in a cove at Smith Mountain Lake contaminated with fecal droppings from 99 ducks and one goose in 1996. The source of the salmonella and giardia remain unknown, however, waterfowl were suspected.

The Henrico County Health Department told the property management of the Shoppes at Innsbrook that waterfowl pose a threat to personal health because the ducks feed from the same tables as restaurant patrons. Management was instructed to remove the threat to personal health.

Fecal droppings comprise 54% of the damage complaints and the public is concerned about diseases, how to sanitize walkways and landscaping, odor, and visitors and employees slipping on fecal droppings and falling (Table 4). While the public may be concerned about disease transmission from fecal droppings, the probability of contracting disease from fecal droppings is believed to be small.

2.3.2 Property damage involving urban ducks

Urban ducks cause automobile accidents and property damage when drivers try to avoid hitting ducks in roadways. Ducks can be a nuisance when property owners must spend time and effort to clean fecal droppings from piers, docks, rafts, boats, beaches, walkways, and lawns from large numbers of ducks. Some people consider ducks a nuisance when the birds return daily to swimming pools and defecate in the pool. Businesses are also concerned about the negative aesthetic appearance of their property caused by excessive droppings and are sensitive to comments by clients and guests.

2.3.3 Duck damage to natural resources

Urban ducks have impacted natural resources in Virginia by being vectors of disease to other feral and wild ducks (Brand 1987, G. Costanzo, VDGIF, pers. commun.). Duck virus enteritis, a.k.a. DVE, is one of the more common contagious wildlife diseases occurring in Virginia and the release of infected domestic or captive-reared waterfowl is frequently the genesis of these epizootics. Outbreaks of DVE occur annually in Fairfax County or Norfolk/Virginia Beach areas. These outbreaks usually result in the annual death of hundreds to thousands of waterfowl. Also, some waterfowl can survive the initial infection and become a carrier to infect uninfected swans, geese, and ducks (Brand 1987).

2.3.4 Where duck damage has been reported

Urban duck damage has been reported in urban areas of Bedford, Caroline, Chesterfield, Dinwiddie, Fairfax, Franklin, Gloucester, Henrico, Middlesex, Montgomery, Page, Spotsylvania, Stafford, Tazewell, Warren, Westmoreland, York, and Roanoke counties, and the cities of Virginia Beach, Norfolk, Newport News, Hampton, Chesapeake, Richmond, Petersburg, Poquoson, Staunton, and Winchester.

Table 4. Number and types of duck damage reported to USDA-APHIS-Wildlife Services from October 1992 through September 1997.

Type of damage	Number of incidents	Percent
fecal droppings	76	54
aircraft strike	1	1
disease threat to wildlife	8	6
other disease threat to humans	23	16
excessive browsing	7	5
nuisance	12	9
other	13	9
TOTAL	140	100

2.4 RESIDENT CANADA GOOSE BIOLOGY AND STATUS

Present-day populations of resident (non-migratory) Canada geese originated from birds that were released or escaped from private waterfowl collections or hunting clubs 40-50 years ago, and from birds that were moved here from other areas (Costanzo 1993). These geese are descendants from non-migratory stocks of geese and probably include a mix of several different subspecies including the giant (*Branta canadensis maxima*), western (*B. c. moffitti*), and interior (*B. c. interior*) races of Canada geese. Twenty years ago, the resident Canada goose population in Virginia was limited to northern and northern Piedmont regions. The population of geese has grown and expanded statewide to more than a quarter million.

Population status of resident Canada geese in Virginia has been determined by VDGIF staff using survey data from the Atlantic Flyway Breeding Waterfowl Plot Survey since 1991 (Table 5). Local breeding populations of resident Canada geese have been increasing for seven of the last eight years (Table 5). Resident Canada geese in Virginia average a 12% annual population growth (G. Costanzo, VDGIF, pers. commun.) This increase may be the result of exploitation of man-made food resources, i.e., grass, turf, (Conover and Chasko 1985) and a predator reduced urban/suburban environment. Resident Canada geese residing mainly in urban or suburban settings in Virginia are afforded almost complete protection from harvest by hunting (U.S. Fish and Wildlife Service 1998).

Resident Canada goose feeding behavior, habitat preference, breeding behavior, and adaptability to man-made environments create situations in which Canada geese and humans conflict. Canada geese feed on clover, grasses, and cereal grains. Along the Atlantic Flyway, Canada geese seem to have forsaken aquatic plants for upland crops (Bellrose 1976). Canada geese also favor short, manicured grass, particularly near a water source, for loafing and feeding. Golf courses and other developed areas provide the food, water, and protection from predators needed by resident Canada geese (Conover and Chasko 1985). Additionally, these areas often harbor few predators, and humans feeding the geese make developed environments more attractive to the geese.

Both non-migratory (resident) and migratory Canada geese occur in Virginia. Migratory Canada geese occur in Virginia from late September through early March (G. Costanzo, VDGIF, pers. commun.). Banding studies show a majority of resident Canada geese remain within 20-25 miles of where captured and banded (G. Costanzo, VDGIF, pers. commun.) unless severe winter weather forces the resident Canada geese to migrate (P. Costelli, NJ Fish and Game, pers. commun., Johnson and Castelli, unpublished data). Ninety-five percent of resident Canada geese observed wintering in the Chesapeake Bay region (Delaware, Maryland, and Virginia) did not migrate (Hestbeck 1995).

Resident Canada geese nest from March through June in Virginia. Eggs take approximately 30 days to hatch. Parent geese are very protective and aggressive in defense of the nest and young. This aggressive behavior sometimes leads to attacks on humans.

Table 5. Estimated population of resident Canada geese in Virginia from the Atlantic Flyway Breeding Waterfowl Plot Survey, 1991 - 1998. Survey conducted by VA Dept. of Game and Inland Fisheries.

Year	Number of Canada geese
1991	66,169 \pm 88%
1992	121,225 \pm 74%
1993	128,603 \pm 82%
1994	129,408 \pm 73%
1995	202,602 \pm 85%
1996	208,146 \pm 72%
1997	301,416 \pm 85%
1998	254,000 \pm 76%

A special September hunting season for resident Canada geese was initiated in 1993 and has been conducted each year since that time (Table 6). The objectives of the season are twofold: 1) to help control the growth rate of this population, and 2) to provide recreational opportunities for waterfowl hunters (Costanzo 1994). The traditional hunting season for Canada geese occurs in winter (November through January), and allows for the harvest of both resident and migratory Canada geese (Table 6). This season, however, was closed in 1995 due to declining numbers of migratory Canada geese (*Branta canadensis interior*) caused by successive years of poor nesting conditions in the Arctic. A special late winter hunting season was initiated in 1997 to further control the growth rate of resident Canada geese (Table 6). This hunting season is only offered west of Interstate 95 to minimize potential harvest of migratory Canada geese which winter primarily east of Interstate 95.

Table 6. Number of Canada geese harvested during September and November through January hunting seasons in Virginia, 1993 - 1998. Data provided by VA Department of Game and Inland Fisheries.

Year	September	November - January	January - February
1993	2,316	11,484	-
1994	3,464	12,136	-
1995	5,500	Season closed	-
1996	9,200	Season closed	-
1997	10,500	Season closed	12,000
1998	-	-	15,400

2.4.1 Economic value of waterfowl

There are several methods available to value wildlife: travel cost method, contingency value (how much a person is willing to pay for experience), expenditure value (how much was spent to "use" that species), and hedonic (how much a person would pay to see or use wildlife). Currently the travel cost and expenditure value methods are the most frequently used for valuing wildlife (J. Parkhurst, VPI & SU, pers. commun.). The average annual cost per hunter to pursue migratory birds in Virginia was \$164 for all economic components: lodging, food, transportation, equipment and other costs (FWS 1996). The average annual cost per resident to watch (view, feed, photograph) wildlife in Virginia was \$308 for all economic components (FWS 1996). This analysis provides the value of wildlife or waterfowl to the public in Virginia which "uses" wildlife, but not the value of waterfowl to a resource owner or local community with damage from waterfowl.

The value of an animal as determined by humans is dependent on personal values and outlook of the individual making the determination. The monetary value of Canada geese to "consumptive users" (hunters) was \$44.12 per bird (FWS 1997). The monetary value of Canada geese to non-consumptive users" was \$0.41 per bird (FWS 1997, D. Laughland, FWS, pers. commun.). The value of geese to consumptive users is much higher than the value of geese to non-consumptive users because the consumptive user measures value as cost to harvest a goose whereas the non-consumptive user measures value as all geese seen. The pure value (cost to produce a bird from an egg to adult) of a domestic white goose and duck was \$8.50, each (P. Egghorn, VDACS, pers. commun.). The pure value of a Canada goose and mallard duck would probably be similar to a domestic goose and duck.

The property owner or local community with the waterfowl makes its own determination of the economic and aesthetic value of waterfowl versus the cost to alleviate damage. This information is incorporated into the decision process by the resource owners or local community when deciding if action will be taken to alleviate damage and which methods will be used to alleviate damage.

2.5 URBAN DUCK BIOLOGY AND STATUS

Many ducks of domestic or semi-wild genetic backgrounds have been released by humans into urban environments. Ducks have been purchased and released by property owners for their aesthetic value. Additionally, ducks are given as gifts to children or as presents around Easter and are later released by owners no longer wanting to care for the ducks. These releases were made in business parks, universities, wildlife management areas, parks, military bases, and housing developments by known and unknown individuals. Most of the time, these birds are released with no regard or understanding of the consequences or problems they can cause to the environment or the local community. Some of the problems to the environment and local community include consumption of shoreline grasses resulting in erosion when large numbers of ducks are released, conflicts among neighbors because released birds defecate in

pools or are aggressive to people during nesting season, and loss of shoreline recreation areas for outdoor activities (e.g., picnics, tossing a football among friends, sunbathing, etc.) because of large numbers of fecal droppings.

Federal law protects all migratory birds, including migratory birds which are hybrids of domestic waterfowl (Title 50, Code of Federal Regulations, Part 10). Urban ducks in Virginia may be of mixed heritage and may show feather coloration of domestic ducks. The ducks may contain bloodlines of Peking, Muscovy, barnyard mallard, and other domestic ducks. Some urban ducks are incapable of sustained flight and some are incapable of flight at all due to hybridization.

The coloration of feathers of urban ducks is highly variable and often does not resemble that of wild mallard ducks (*Anas platyrhynchos*). Urban ducks in Virginia often display the following physical characteristics: males may be missing the white neck ring or the neck ring will be an inch wide instead of the narrower 1/4 inch wide ring found on wild mallards, males may have purple heads instead of green heads, females may be blond instead of mottled brown, bills of females may be small and black instead of orange mottled with black, either sex may have white coloration on the wings, tail, or body feathers, and ducks may weigh more than wild mallards (2.5 - 3.5 pounds).

Historically, wild mallards may have bred in western Virginia in sparse density. Wild mallards have spread throughout Virginia in the past 40-50 years. An annual breeding population survey is conducted annually by VDGIF. The survey estimates the wild mallard breeding population statewide; however, the status of urban ducks is unknown. Urban ducks survive and reproduce from February through June in urban/suburban areas of Virginia.

Urban ducks feed on aquatic and emergent vegetation, seeds, small insects and other invertebrates and human foods (i.e., bread, popcorn, doughnuts, corn, other grains). The availability of human foods contributes to supporting an abundance of these ducks which would otherwise be lower if human foods were unavailable.

Urban ducks prefer to be near a water source, but can be found long distances from water. Urban environments harbor few predators, and the major cause of mortality appears to be from automobiles.

2.6 WILDLIFE ACCEPTANCE CAPACITY

Human dimensions of wildlife management include identifying how people are affected by problems or conflicts between them and wildlife, attempting to understand people's reactions, and incorporating this information into policy and management decision processes and programs (Decker and Chase 1997).

Wildlife acceptance capacity is the limit of human tolerance for wildlife or the maximum number of a given species that can coexist compatibly with local human populations. Wildlife acceptance capacity is also known as the cultural carrying capacity. These terms are important in urban areas because they define the sensitivity of a local community to a specific wildlife species. For any given damage situation, there will be varying thresholds by those directly and indirectly affected by the damage. This threshold of damage is a primary limiting factor in determining the wildlife acceptance capacity.

Biological carrying capacity is the land or habitat's limit for supporting healthy populations of wildlife without degradation to the animal's health or its environment over an extended period of time (Decker and Purdy 1988). While the Commonwealth of Virginia has a biological carrying capacity to support substantially more than the current 300,000+ resident Canada geese, the wildlife acceptance capacity is much lower. The wildlife acceptance capacity for resident Canada geese in Virginia appears to be approximately 25 - 30 birds for an 18-hole golf course. Conover and Chasko (1985) found a similar wildlife acceptance capacity for resident Canada geese at golf courses in Connecticut. The wildlife acceptance capacity for resident Canada geese in most subdivisions and water front communities appears to be approximately 20 - 30 resident Canada geese. Once this wildlife acceptance capacity is met or exceeded, people will begin to implement population control methods, including capture and euthanasia, to alleviate property damage and human health or safety threats related to the accumulation of fecal droppings. The

Canada goose wildlife acceptance carrying capacity for other damage situations is unknown. The wildlife acceptance capacity for urban ducks appears to range from 20 - 50 birds in waterfront communities and most business parks.

2.7 SUMMARY STATEMENT OF NEED FOR ACTION

This document addresses the need for WS assistance in responding to requests for resident Canada goose and urban/suburban duck damage management services in the Commonwealth of Virginia.

3.0 ISSUES

Issues have been identified from comments received from the public and state and federal government agencies through various public involvement processes since 1996. Several patterns emerged from the comments which indicated key points of concern. The issues are summarized below:

3.1 AESTHETICS

Wildlife generally is regarded as providing economic, recreational, and aesthetic benefits (Decker and Goff 1987), and the mere knowledge that wildlife exists is a positive benefit to many people. However, wildlife may also be responsible for negative impacts. The activities of some wildlife result in economic losses to agriculture and damage to property. Human safety is jeopardized by wildlife collisions with aircraft and automobiles, and wild animals may harbor diseases transmissible to humans. Predation by, or to, wildlife species that have special status, such as threatened or endangered species, is a public concern. Some types of wildlife are regarded as nuisances in certain settings.

3.1.1 Definition of aesthetics

Aesthetics is the philosophy dealing with the nature of beauty, or the appreciation of beauty. Therefore, aesthetics is truly subjective in nature; dependent on what an observer regards as beautiful.

3.1.2 Positive values of wildlife

Wildlife populations provide a range of social and economic benefits (Decker and Goff 1987). These include direct benefits related to consumptive and non-consumptive use (e.g., wildlife-related recreation, observation, harvest, sale), indirect benefits derived from vicarious wildlife related experiences (e.g., reading, television viewing), and the personal enjoyment of knowing wildlife exists and contributes to the stability of natural ecosystems (e.g., ecological, existence, bequest values) (Bishop 1987). Positive values of wildlife would also include having enough wildlife to view, but also to enjoy the aesthetics of the local environment without excessive animal excrement or loss of vegetation (lawns and flower gardens) due to wildlife feeding on plants deemed important by some people.

3.1.3 Negative values of wildlife

However, the same wildlife populations that are enjoyed by many also create conflict with a number of land uses and human health and safety. The activities of some wildlife, such as white-tailed deer and Canada geese, result in economic losses to agriculture and damage to property. Human safety is jeopardized by wildlife collisions with aircraft and automobiles, and wild animals may harbor diseases transmissible to humans. Predation by, or to, wildlife species that have special status, such as threatened or endangered species, is a public concern. Certain species of wildlife are regarded as nuisances in certain settings. Excessive numbers of wildlife can ruin the aesthetic appearance and enjoyment of some recreational activities because of excessive fecal droppings or disruption of vehicle traffic.

3.1.4 Direct and indirect benefits of wildlife

Direct benefits are derived from a user's personal relationship to animals and may take the form of direct consumptive use (using up the animal or intending to) or non-consumptive use (viewing the animal in nature or in a zoo, photography) (Decker and Goff 1987). Indirect benefits or indirect exercised values arise without the user being in direct contact with the animal and come from experiences as looking at photographs and films of wildlife, reading about wildlife, or benefitting from activities or contributions of animals such as their use in research (Decker and Goff 1987). Indirect benefits come in two forms: bequest and pure existence (Decker and Goff 1987). Bequest is providing for future generations and pure existence is merely knowledge that the animals exist (Decker and Goff 1987).

3.1.5 Aesthetic value of wildlife varies among people

Public reaction is variable and mixed because there are numerous philosophical, aesthetic, and personal attitudes, values, and opinions about the best ways to manage conflicts/problems between humans and wildlife. The population management (capture and euthanasia) method provides relief from damage or threats to human health or safety to urban/suburban people who would have no relief from such damage or threats if nonlethal methods were ineffective or impractical. Many people directly affected by problems and threats to human health or safety caused by resident Canada geese and/or urban ducks insist upon their removal from the property or public location when the wildlife acceptance capacity is exceeded. Some people have the view that resident Canada geese should be captured and relocated to a rural area to alleviate damage or threats to human health or safety. Some people directly affected by the problems caused by resident Canada geese and/or urban ducks strongly oppose removal of the birds regardless of the amount of damage. Individuals not directly affected by the harm or damage may be supportive, neutral, or totally opposed to any removal of resident Canada geese and/or urban ducks from specific locations or sites. Some of the totally opposed people want WS to teach tolerance for waterfowl damage and threats to human health or safety, and that waterfowl should never be killed. Some of the people who oppose removal of waterfowl do so because of human-affectionate bonds with individual geese or ducks. These human-affectionate bonds are similar to attitudes of a pet owner and result in aesthetic enjoyment.

3.2 ANIMAL WELFARE

3.2.1 Killing geese and ducks

People vary greatly on their views regarding the killing of ducks and geese. Some feel that population reduction is an appropriate form of animal damage management. Some people oppose the killing of Canada geese and urban ducks as a method of management and some believe that these animals should only be killed in certain ways. Some groups feel that killing of any wildlife is wrong and inhumane.

3.2.2 Humaneness

The issue of humaneness, as it relates to the killing or capturing of wildlife, is an important but very complex concept that can be interpreted in a variety of ways. Humaneness is a person's perception of the impact of an action, and individuals may perceive the humaneness of an action differently. Many groups, including animal welfare and animal rights organizations, are concerned that some methods used by WS to control wildlife damage are inhumane. In this situation, the issue is whether the methods used in a wildlife damage control activity expose the targeted animal to unnecessary pain and suffering. Most animal welfare organizations do not oppose the concept of wildlife damage control, but support more restrictions on control methods perceived as inhumane and greater use on nonlethal controls. Animal rights advocates oppose killing or harming animals for human gain because they believe animals have rights equal to or similar to humans (Schmidt 1989, Wywiałowski 1991).

WS personnel are experienced and professional in their use of management methods, and methods are applied as humanely as possible. For situations in which it is practical to capture and euthanize wild animals, WS follows euthanasia methods recommended by the American Veterinary Medical Association (AVMA) or the recommendations of a veterinarian, even though the AVMA euthanasia methods were developed principally for companion animals and slaughter of food animals, and not for free-ranging wildlife.

3.3 EFFECTS ON HUMAN HEALTH AND SAFETY

Many people are concerned about disease from the excessive accumulations of Canada goose and duck fecal material which they come into contact with when recreating, eating, or conducting other outdoor activities near water bodies containing ducks and geese. People are especially concerned for their children who may be playing in feces at school and in parks. Adults become concerned and upset that they are expected by some people to play golf, volleyball, and other activities in waterfowl feces. A few people that get their drinking water from springs or ponds

are concerned about their family's health from drinking water contaminated with excessive goose feces. These health concerns result in part from health officials instructing citizens to avoid contact with fecal material and areas with excessive quantities of fecal material on the landscape, and health officials issuing health advisories which close ponds or parts of lakes to human use because of excessive bacteria from waterfowl feces.

Many people, especially airport employees and military personnel, are sensitive to aircraft - waterfowl strikes because damage, while costly to the aircraft, can result in crashes and life threatening experiences (See section 2.1.2.5 Threats to aviation). Some people have concern about the safety of flying when they see waterfowl living at an airport because of stories in the media about wildlife-aircraft strikes.

Most of the public is intolerant of Canada geese when their children are bitten or beaten by the geese, regardless of the fact the goose may think it is protecting its nest or young. Most of the public feels it should be able to walk near ponds, lakes, and other water bodies without being attacked by Canada geese. Moreover, most of the public gets aggravated and sometimes scared when they are attacked (bitten, chased, or beaten with wings) by Canada geese protecting nests at places of business. Lastly, Canada geese and urban ducks cause concern for human safety and, infrequently, fear in some people because evasive action to avoid striking waterfowl with an automobile can result in a collision with another car or stationary object.

3.4 BIOLOGICAL IMPACTS OF MANAGEMENT ACTIONS

WS activities are conducted for the purpose of alleviating wildlife damage or other wildlife problems. No WS activities are conducted to extirpate a species. The WS program operates in accordance with international, national, and state laws and regulations enacted to ensure species maintenance and viability.

3.4.1 Impacts on resident Canada goose and urban duck populations

The cumulative impacts of the different methods employed in the integrated management approach to the proposed action would be expected to slow the population growth rate of resident Canada geese and reduce the number of complaints of waterfowl damage or threats to human health or safety coming from the same local area in Virginia. No more than 5% of the statewide population of resident Canada geese will be killed with the capture/euthanasia alternative in a calendar year. The cumulative impacts of the proposed action would be eradication of some local urban duck populations at specific locations.

Similar resident Canada goose damage management programs with the capture/euthanasia option have been conducted in New York, Minnesota, Michigan, Delaware, and Washington (state). This management program is limited to and specific to Virginia because WS follows state laws and regulations when developing wildlife damage management programs and the state agencies assist in developing the wildlife damage management programs.

3.5 ISSUES CONSIDERED BUT NOT IN DETAIL, WITH RATIONALE

3.5.1 Separating family groups

Some people have expressed concern over the potential separation of goose families through management actions. This could occur through relocation of nuisance/hazardous geese or through removal and euthanasia of the same. Bellrose (1976) has several sources which list annual mortality rates of juvenile Canada geese ranging from 7 to 19% during the hatching to fledgling stage. It is our opinion that juvenile geese have a good likelihood of survival without adult geese once the juvenile reaches fledgling stage which occurs in June for most juvenile geese. Therefore any juvenile geese which escape capture during the molt will most likely survive to adult-hood. Separated adults will form new pair bonds and will readily breed with new mates at the appropriate time of year.

3.5.2 Effects on human health from consuming waterfowl

Waterfowl captured from industrial sites would not be used for human consumption since harmful chemical residues may occur in the tissue of such Canada geese (Amundson 1988, cited from Cooper 1995). There is no evidence in the literature to indicate that resident Canada geese captured on golf courses, parks, or other turf areas are unfit for human consumption (Cooper 1995). Moreover, Canada geese captured and tested for pesticide residues and heavy metals in Virginia during 1998 had no pesticide residues and no heavy metals except zinc and copper which were within dietary requirements established by the National Academy of Science according to the Virginia Department of Health (M. Lowney and P. Eggborn, unpublished data). Additionally, a risk analysis conducted by USDA-APHIS-Policy and Program Development determined "...there is a very low risk of human health effects associated with the consumption of goose meat." And the risk analysis further concluded that "...there is no evidence of risk which support the expenditure of additional resources to further quantify risk" (L. Miller, 1998, unpublished report).

3.5.3 Specificity of methods by species/situation

Once a wildlife damage assessment is completed, all available methods are evaluated for their practicality in addressing the problem involving wildlife causing damage. Different methods are practical and effective for different species, depending on the characteristics and behavior of that species. For example, a fence can be erected around an area in order to exclude certain mammal species. However, a fence will not exclude most bird species. For this reason, methods used to reduce damage usually are specific to related species.

More specifically, Canada geese, due to their molting behavior which renders them flightless for approximately 3-4 weeks each year, can be rounded up and captured during mid-June through mid-July. However, ring-billed gulls do not exhibit this molting behavior and, therefore, harassment and shooting is a more appropriate and common method of gull removal.

3.5.4 Impacts on migratory Canada goose

Migratory Canada geese winter primarily east of Interstate 95 (G. Costanzo, pers. commun.) and usually in rural or wild areas away from urban/suburban areas and people. An estimated 5,000 Southern James Bay population and 1,000 to 2,000 Ungava Peninsula population of migratory Canada geese winter west of Interstate 95 in Virginia (G. Costanzo, VDGIF, pers. commun.). The majority of migratory Canada geese (Table 7) winter east of Interstate 95 (G. Costanzo, VDGIF, pers. commun.).

If WS conducted direct control, primarily shooting Canada geese in agricultural areas to supplement harassment, there is the possibility of killing migratory Canada geese. It is expected that less than 100 migratory Canada geese would be killed by WS in a calendar year to protect agriculture. The taking of 100 migratory Canada geese would have represented 0.0016% of the population wintering in Virginia during 1998-99 (Table 7). The taking of migratory Canada geese is a minor part of the proposed action.

The FWS tolerates up to 10% of the harvest of Canada geese during the special early (September) hunting season and 20% of the harvest of Canada geese during the special late (December through February) hunting season to be comprised of migratory Canada geese (J. Serie, FWS, pers. commun.) (Table 6). The FWS also issues migratory bird depredation permits to take migratory Canada geese for farmers trying to protect their crops from depredation in Virginia. Four permits allowing a total take of 295 Canada geese during winter 1998-1999 were issued by the FWS to protect Virginia agriculture in areas where migratory Canada geese would be expected to be found. The shooting of 100 or less migratory Canada geese by WS to reinforce harassment will have no significant adverse impacts on the growth of the Atlantic population of migratory Canada geese wintering in Virginia (J. Serie, FWS, pers. commun.).

Table 7. Index of Canada geese wintering east of Interstate 95 in Virginia as determined by the January Mid-Winter Inventory conducted by the Virginia Department of Game and Inland Fisheries.

Year	Number of Canada geese seen
1994	39,000
1995	42,180
1996	52,753
1997	47,853
1998	63,588

VDGIF conducts a Mid-Winter Inventory of Canada geese wintering east of Interstate 95 each January (Table 7). The inventory provides an annual index of what is believed predominately migratory Canada geese (G. Costanzo, VDGIF, pers. commun.). Canada geese are counted in areas historically used by migratory Canada geese (e.g., large grain fields, rivers) and Canada geese seen in areas of known resident Canada geese (e.g., golf courses, subdivisions) are excluded from the inventory (G. Costanzo, VDGIF, pers. commun.).

3.5.5 Genetic integrity of species

State and federal wildlife management agencies want to conserve and protect species of wildlife. The release of domestic or non-native wildlife (e.g., Muscovy ducks, Peking ducks, Grey lag geese) may be harmful to native species (e.g., mallard ducks, Canada geese). Species of wildlife have evolved and survived over time by maintaining their genetic fitness. Genetic conservation of wild vertebrates has emphasized the prevention of decay in heterogeneity and dilution of co-adapted gene complexes by mixing stocks - something often associated with propagation and release efforts (Meffe 1986, cited from Warner and Philipp 1988). When wildlife are hybridized with domestic wildlife their survival is jeopardized.

4.0 PUBLIC INVOLVEMENT

4.1 SOLICITATION FOR INPUT, INFORMATION, AND ISSUES

A letter was sent to 76 state and federal agencies, organizations, businesses, and individuals in 1996 requesting comments, issues, concerns for an environmental assessment about managing damage involving Canada geese and urban/suburban ducks.

A meeting of stakeholders was held on August 29, 1996 to review the environmental assessment and make comments. The following organizations were invited to a stakeholder meeting and attended: Loudoun Wildlife Conservancy, Dulles International Airport, Virginia Department of Agriculture and Consumer Services, Virginia Department of Game and Inland Fisheries, Virginia Department of Conservation and Recreation, Colonial Williamsburg Foundation, Upper Occoquan Sewage Authority, Richmond Audubon Society, Virginia Federation of Humane Societies, Airlie Environmental Studies, Golden Horseshoe Golf Club, Virginia Power, Northern Virginia Regional Park Authority, Ford's Colony Country Club, and Lake Barcroft Watershed Improvement District. The following organizations were invited to a stakeholder meeting and were unable to attend: The Wildlife Center of Virginia, Virginia Wildlife Federation, Sierra Club, U.S. Navy, Old Dominion Golf Course Superintendents Association, Belhaven Country Club, Virginia Trappers Association, Old Town Farm, Virginia Farm Bureau, Little Keswick School, Veterans Administration Medical Center, Virginia Agri-Business Council, Kingsmill Resort, and College of William and Mary.

A meeting was held with animal activist organizations on January 27, 1998 to discuss the management of Canada geese in Virginia. The meeting was attended by representatives of the Humane Society of the United States, Citizens for the Preservation of Wildlife, People for the Ethical Treatment of Animals, Fund for Animals, The Canada Goose Group, and Action for Animals Network. An environmental organization, Wildlife Preservation and Management Council, also attended this meeting.

The Humane Society of the United States also met with WS to discuss the Canada goose damage management program in Virginia on October 18, 1997 and at a management team meeting in January 1998.

4.2 PUBLIC NOTICE OF AVAILABILITY OF THE ENVIRONMENTAL ASSESSMENT

The public was notified of a 30-day comment period on the draft environmental assessment through publication of a legal notice on June 30, 1996 through July 4, 1996 in the Richmond Times-Dispatch and Roanoke Times.

Additionally, the public was notified of a 30-day comment period and availability of a draft environmental assessment through publication of a legal notice on September 1, 1998 in the Richmond Times-Dispatch, Roanoke Times, Washington Times, and Virginia Pilot. Also, a notice of a 30-day comment period on the draft environmental assessment was published in the Federal Register on October 14, 1998.

5.0 ALTERNATIVES INCLUDING THE PROPOSED ACTION

5.1 NO ACTION

An assessment of the No Action Alternative is required under CEQ Regulations on Implementing National Environmental Policy Act Procedures (40 CFR 1502.14(d)). Under certain circumstances, the No Action Alternative involves a "no change" approach to the action being studied; in other situations, it involves a "do nothing at all" approach. For the purposes of this EA, the No Action Alternative is considered a "do nothing at all" approach. Under this alternative, there would be no APHIS WS program actions in Virginia directed at management of damages associated with resident Canada geese and urban/suburban ducks. WS would provide no technical assistance or direct control services.

All requests for goose/duck damage management assistance would be denied by WS and/or directed to the FWS, VDGIF, VDACS, local animal control agencies, or private businesses or organizations. Technical assistance might be available from any of these entities. Wildlife damage management methods would most likely be implemented by resource owners, private businesses, or volunteers. Any assistance (technical or direct control) provided by the FWS, VDGIF, VDACS, and local animal control agencies would be funded by the respective agency providing the assistance as these agencies could not accept reimbursement from service recipients. Private businesses could provide assistance on a reimbursable basis. Volunteer services could be provided at no cost to the resource owner.

Individuals or agencies might choose to use contractual services of private businesses, use volunteer services of private organizations, implement damage management actions themselves, or take no action. Implementation would be influenced by laws and regulations, resource owners' tolerance of damage and their ability to absorb losses, and public demand for controlling goose and duck damage to public and private properties and facilities. In some cases, control methods could be employed contrary to their intended use or in excess of what is necessary. Not all of the methods listed in Appendix I as potentially available to WS would be legally available to all other agencies or individuals (Table 8).

Requests for lethal wildlife damage management services would be referred to the FWS and Virginia Department of Game and Inland Fisheries from whom permits could be requested to allow the property owners or resource managers to implement lethal methods themselves or contract others to do so. However, FWS issuance of a permit to take (capture or kill) waterfowl is presently contingent upon such a recommendation by WS. Permit issuance by VDGIF is presently contingent upon FWS permit issuance. Therefore, under this alternative, these agencies might not issue permits to resource owners to take geese or ducks.

5.2 NON-LETHAL PROGRAM ONLY

Under this alternative, only nonlethal management approaches would be used or recommended by WS. Both technical assistance and direct control services would be provided.

Requests for lethal wildlife damage management services would be referred to the FWS and Virginia Department of Game and Inland Fisheries from whom permits could be requested to allow the property owners or resource managers to implement lethal methods themselves or contract others to do so. However, FWS issuance of a permit to take (capture or kill) waterfowl is presently contingent upon such a recommendation by WS. Permit issuance by VDGIF is presently contingent upon FWS permit issuance. Therefore, under this alternative, these agencies might not issue permits to resource owners to take geese or ducks.

WS technical assistance would be funded through WS Federal appropriations. WS direct control services such as harassment efforts and construction of physical exclusion structures (Appendix I) would be funded by service recipients. Technical assistance could also be available from the FWS, VDGIF, VDACS, local animal control agencies, or private business and organizations. Wildlife damage management methods could also be implemented by resource owners, private businesses, or volunteers. Any assistance (technical or direct control) provided by the

FWS, VDGIF, VDACS, and local animal control agencies would be funded by the respective agency providing the assistance as these agencies could not accept reimbursement from service recipients. Private businesses could provide assistance on a reimbursable basis. Volunteer services could be provided at no cost to the resource owner.

Agencies or individuals might choose to implement WS nonlethal recommendations, implement lethal methods not recommended by WS, use contractual services of private businesses, use volunteer services of private organizations, or take no action. In some cases, control methods could be employed contrary to their intended use or in excess of what is necessary. Not all of the methods listed in Appendix I as potentially available to WS would be legally available to all other agencies or individuals (Table 8).

5.3 LETHAL PROGRAM ONLY

Under this alternative, only lethal direct control services and technical assistance would be provided by WS. Technical assistance would include making recommendations to the FWS and VDGIF regarding the issuance of permits to resource owners to allow them to take geese and ducks by lethal methods. Requests for information regarding nonlethal management approaches would be referred to VDGIF, VDACS, FWS, local animal control agencies, or private businesses or organizations.

WS direct control services would be conducted as authorized by various federal and state regulations (see 1.3.2 **Compliance with Other Federal and State Statutes**) and would be fully funded by service recipients. WS technical assistance would be funded through WS appropriations. Requests for information regarding nonlethal approaches to manage damage by resident Canada geese and urban ducks would be referred to VDGIF, VDACS, FWS, local animal control agencies, or private businesses or organizations. Any assistance (technical or direct control) provided by the FWS, VDGIF, VDACS, and local animal control agencies would be funded by the respective agency providing the assistance as these agencies could not accept reimbursement from service recipients. Private businesses could provide assistance on a reimbursable basis. Volunteer services could be provided at no cost to the resource owner.

Individuals or agencies might choose to implement WS lethal recommendations, implement nonlethal methods or other methods not recommended by WS, contract for WS direct control services, use contractual services of private businesses, use volunteer services of private organizations, or take no action. In some cases, control methods employed by others could be contrary to the intended use or in excess of what is necessary. Not all of the methods listed in Appendix I as potentially available to WS would be legally available to all other agencies or individuals (Table 8).

5.4 INTEGRATED WILDLIFE DAMAGE MANAGEMENT PROGRAM (PROPOSED ACTION)

Under this alternative, WS would provide both technical assistance and direct control services including both nonlethal and lethal management approaches. Integrated wildlife damage management (IWDM) strategies would be recommended and used encompassing the use of practical and effective methods of preventing or controlling damage while minimizing harmful effects of control measures on humans, other species and the environment. Nonlethal methods would be given first consideration in the formulation of each damage management strategy, and would be recommended or implemented when practical and effective before recommending or implementing lethal methods. The IWDM approach could be applied by WS on any property in the Commonwealth of Virginia where the property owner or manager requests assistance in resolving goose or duck damage problems.

This IWDM approach would consist of implementing one or more of three action approaches: resource management, physical exclusion, and wildlife management. Each of these action approaches is a general strategy for addressing wildlife damage situations. Within each approach there are available a number of specific methods or tactics. Selection of the appropriate approach and method is the result of the APHIS WS decision-making process discussed in Section 5.4.2. In determining the sequence or combination of methods to be applied and who will apply them,

preference would be given to practical and effective nonlethal methods. However, nonlethal methods would not always be applied as a first response to each damage problem. The most appropriate response could often be a combination of nonlethal and lethal methods and there could be instances where application of lethal methods alone would be the most appropriate strategy.

WS technical assistance would consist of activities as described in section 5.4.1.2 -- **Services Provided by Wildlife Services** and would be funded by WS federal appropriations. Technical assistance might also be independently provided by FWS, VDGIF, VDACS, local animal control agencies, or private businesses or organizations. Assistance provided by FWS, VDGIF, VDACS, and local animal control agencies would be paid for from the respective federal, state, or local agency funds. Assistance provided by private businesses would likely require payment by the service recipient. Voluntary assistance might be available from some private organizations.

WS direct control services involving various methods, as noted in Appendix I would be conducted as authorized by various federal and state regulations (see 1.3.2 **Compliance with Other Federal and State Statutes**) and would be funded by service recipients. Direct control involving some methods might also be provided by private businesses on a cost-reimbursable basis and by private organizations at no cost. Resource owners would implement some methods themselves.

Individuals or agencies might choose to implement WS recommendations (nonlethal or lethal), contract for WS direct control services (nonlethal or lethal), use contractual services of private businesses, use volunteer services of private organizations, or take no action. In some cases, control methods employed by others could be contrary to the intended use or in excess of what is necessary. Not all of the methods listed in Appendix I as potentially available to WS would be legally available to all other agencies or individuals (Table 3).

5.4.1 Wildlife damage management approaches

5.4.1.1 Definition of wildlife damage management

Wildlife damage management, or control, is defined as the alleviation of damage or other problems caused by or related to the presence of wildlife (USDA 1994).

5.4.1.2 Services provided by Wildlife Services

The mission of WS is to provide Federal leadership in managing problems caused by wildlife. WS recognizes that wildlife is an important public resource greatly valued by the American people. By its very nature however, wildlife is a highly dynamic and mobile resource that can damage agriculture, property and industrial resources, pose risks to human health and safety, and affect other natural resources. The WS program carries out the Federal responsibility for helping to solve problems that occur when human activity and wildlife are in conflict with one another.

5.4.1.2.1 Technical Assistance

Technical assistance provided by WS consists of WS personnel providing verbal or written advice, recommendations, information, demonstrations or training, and distributing literature and materials for others to use in managing wildlife damage problems. Technical assistance is usually provided following an on-site visit or verbal consultation to determine the nature and history of the problem, extent of damage, and identification of the species responsible for damage. Assistance may be given in identifying the responsible wildlife species and determining the extent of damage. WS may provide recommendations concerning habitat modification, cultural practices to reduce the likelihood of wildlife damage, behavior modification of the troublesome species, or ways to reduce specific wildlife populations to control the amount of damage they cause. Explanation of the biology, behavior, and population ecology of the species responsible for damage is occasionally sufficient to satisfy the resource owner's information needs and may result in no damage control actions being taken. APHIS NEPA implementing regulations categorically exclude technical assistance from the requirement to prepare an EA or EIS (7 CFR 372.5(c), 60 Fed. Reg. 6,000-6,003, 1995).

WS personnel may suggest the use of nonlethal, lethal, or a combination of techniques in resolving wildlife damage conflicts. Nonlethal recommendations may include, but are not limited to, habitat modification and manipulation, scaring devices, behavioral modification, exclusion devices and physical barriers, visual repellents, live capture, translocation, guarding animals, and animal husbandry. Lethal methods recommended in technical assistance may include traps and other capture devices, shooting, removal or destruction of eggs and/or nests, and chemical toxicants. Such assistance takes into account environmental factors and relevant laws and regulations. Where appropriate, WS recommends that regulatory agencies issue permits to allow resource owners to deal with wildlife problems. For a more detailed discussion of methods specific to management of goose and duck damage, see Appendix I.

Recipients of technical assistance receive information from WS or the appropriate regulatory agency regarding legal and responsible methods of control. This includes application procedures as well as biological and environmental impacts of these methods. Recipients of WS technical assistance are responsible for implementation of recommended control actions. The WS program does not control the actions, if any, taken by others.

5.4.1.2.2 Direct Control

Direct control is conducted by WS personnel in the field and typically consists of identification of the source of the problem and implementation of practical control actions. Direct control is usually provided when the resource owner's efforts, such as habitat modification or husbandry practices, are ineffective and technical assistance alone is inadequate. Direct control services provided by WS in Virginia are provided on a cost-reimbursable basis. This funding is usually provided by resource owners, private businesses, or local, state or federal agencies. Wildlife Services personnel consider practical methods for resolving damage problems and take action by implementing the most strategically appropriate measures. Direct control services provided by WS in Virginia have included harassment, wire grid installation, egg and nest destruction, shooting to supplement harassment, capture and relocation, and capture and euthanasia.

5.4.1.2.3 Education

Education is an important element of WS's program activities because wildlife damage management is about finding "balance" or co-existence between the needs of people and needs of wildlife. This is extremely challenging as nature has no balance, but rather, is in continual flux. In addition to the routine dissemination of recommendations and information to individuals or organizations sustaining damage, lectures and demonstrations are provided to farmers, homeowners, and other interested groups. WS frequently cooperates with other agencies in education and public information efforts. Additionally, technical papers are presented at professional meetings and conferences so that WS personnel, other wildlife professionals, and the public are periodically updated on recent developments in damage management technology, laws and regulations, and agency policies.

WS provides informational leaflets about Canada goose damage management and resident Canada goose biology and ecology, and about specific methods (e.g., oiling eggs, overhead wire grids, sources of pyrotechnics). In federal fiscal year 1997, the WS program in Virginia provided 995 leaflets to the public about Canada geese, damage management, and methods. Additionally, leaflets about managing Canada goose damage were given to the VDACS to distribute to the public requesting assistance from the VDACS. WS distributes literature produced by the VDGIF and the FWS on biology and ecology of Canada geese, duck virus enteritis, and the consequences of feeding wildlife.

At the recent 8th Eastern Wildlife Damage Management Conference in Roanoke, Virginia during October 1997, WS personnel from Virginia presented four technical papers and a half day educational field trip to other professional biologists, wildlife enthusiasts, and the public. The papers covered topics such as the management of resident Canada geese, managing wildlife at airports, managing gulls at landfills, and managing coyote predation on livestock. WS in Virginia has also published a "Predator Management Training Manual" for restricted-use pesticide applicators, and has written a training manual on management of vertebrate pests for restricted-use pesticide applicators which should be published in 1999. Also, scientific papers on the weight of eastern coyotes by age, damage by black and turkey vultures in Virginia, and on "Vultures" have been submitted for publication. The Virginia WS program

usually gives presentations on managing wildlife damage annually at Bird Strike Committee USA and Northeast Association of Wildlife Damage Biologists meetings.

5.4.1.2.4 Funding

The WS program in Virginia receives a federal allotment to provide technical assistance to the general public regarding nuisance wildlife and wildlife damage. Direct control services provided by WS in Virginia are provided on a cost-reimbursable basis. This funding is usually provided by resource owners, private businesses, or local, state or federal agencies.

5.4.1.3 Wildlife Damage Management decision making

The WS program receives requests for assistance that encompass a broad range of wildlife damage problems. Each request for assistance is analyzed separately because each request for assistance is unique regardless of its complexity. Therefore, the decision making process must be predicated on consideration of the specific biologic, sociocultural, economic, physical, and other environmental circumstances associated with a given wildlife damage problem (Appendix II, USDA 1994). Ideally, a variety of methods should be available for the decision maker to formulate an effective IWDM strategy (USDA 1994).

All professions, including wildlife damage management, have a relatively similar approach to decision making. The problem is first identified, then a determination is made if the assistance requested is within existing authorities and abilities. Impacts of the problem are considered, and an assessment is made of the actions potentially applicable to the particular situation. This is followed by selection and implementation of those methods or approaches most appropriate. This process concludes with an assessment of the effectiveness of the actions to determine if additional treatment is required.

5.4.1.3.1 Non-lethal methods before lethal methods

WS program policy - Selection of Methods, states "Preference is given to nonlethal methods, when practical and effective." If practical and effective nonlethal control methods are not available and if lethal control methods are available and appropriate for WS to implement, WS may implement lethal methods.

5.4.1.4 Effectiveness of individual methods

The primary social issues relative to managing wildlife damage are humaneness, effectiveness, and ecological soundness. Effectiveness is determined by how quickly, economically and completely the methods resolve the problem. Effective damage resolution is often best attained through the integration of several methods, either simultaneously or sequentially. Methods or management strategies are evaluated considering maximum damage resolution with minimal negative environmental impacts.

5.4.1.4.1 Relocation

Relocation of problem wildlife species is a technique that sometimes is used to alleviate wildlife damage problems. The success of a relocation effort depends on the potential for the problem individuals to be captured efficiently and the existence of an appropriate relocation site (Nielsen 1988). However, relocation of wildlife must be approved by the state wildlife division for it to be a legal alternative. The VDGIF opposes relocation of Canada geese and urban ducks since the potential for damage is moved to the new location as well. Additionally, the VDGIF opposes relocation of urban ducks because of the potential to transmit disease and infect other waterfowl at the release site.

5.4.1.4.1.1 Relocation potentially moves damage/conflict

Maryland Department of Natural Resources and Oklahoma Department of Wildlife Conservation have been unwilling to accept resident Canada geese in 1998 for relocation in Maryland or Oklahoma because of the conflicts and problems associated with resident Canada geese there. The Alabama Division of Game and Fish has a policy

opposing the relocation of problem Canada geese from other states into Alabama.

5.4.1.4.1.2 Relocation may vector disease

Relocated waterfowl have caused epizootic and avian disease outbreaks (e.g., duck virus enteritis) resulting in the death of hundreds of waterfowl annually in Virginia (G. Costanzo, VA Dept. Of Game and Inland Fisheries, pers. commun.).

5.4.1.4.1.3 Relocation potentially ineffective because geese return

Relocation attempts are often unsuccessful. Cooper and Keefe (1997) found 42 - 80% of adult Canada geese relocated from Minnesota to Oklahoma returned to the capture area. Also, Fairaizl (1992) found 19% of juveniles relocated within Nevada returned to the capture area. If relocated, Canada geese would need to be pinioned, or have their wing feathers clipped rendering them flightless, in order to prevent their return to the capture area.

5.4.1.4.2 Creation of alternative habitat

The creation of alternative habitat for the geese would provide problem geese a place to live. However, this alternative would not change the fact that there are food and habitat resources available elsewhere to which the geese could move. In addition, it would only be of value until the population moved or outgrew the area, moving back to areas in which they cause damage. Appendix I, discusses creating alternative habitat as a basic resource management action.

5.4.1.4.3 Efficacy of lethal methods

The magnitude of damage (e.g., quantity of fecal droppings, acres of excessive grazing, risk of bird-aircraft strike, etc.) is proportional to goose abundance. The reduction in Canada goose abundance would yield a proportional reduction in damage to agriculture, property, and natural resources; and a reduction in risk in human health or safety. For this reason, the use of lethal methods to reduce Canada goose damage can be very effective at alleviating damage and the most economical approach to reducing damage when compared to nonlethal methods (Cooper and Keefe 1997). Additionally, capture and euthanasia of Canada geese is the most cost effective lethal method to reduce damage, except for hunting (Cooper and Keefe 1997). Moreover, the use of lethal methods has longer effectiveness than nonlethal methods because it would take months to years before the original local population level of Canada geese returned. Lethal methods would also reduce conflict among resource owners whereas nonlethal actions only move the Canada geese among resource owners (i.e., spread the damage) (Cooper and Keefe 1997, Smith et al. 1999), and possibly leave resource owners with the least financial means burdened with the Canada geese and the damage.

5.4.1.5 Public notice before management action

NEPA analysis determines appropriate federal action and makes notice of the decisions to the public. This Environmental Assessment, in compliance with NEPA, advises the public of the actions to be taken for management of Canada geese as a response to a request for assistance within the Commonwealth of Virginia. According to APHIS procedures implementing the NEPA, specific WS actions can be categorically excluded which would not provide the public the opportunity for comment. However, in order to evaluate and determine if there may be any potentially significant or cumulative impacts from the planned management program, we prepared this EA concerning non-migratory (resident) Canada geese and urban ducks in Virginia.

5.4.1.6 Use of volunteers

Some animal activist organizations have requested the public be referred to their organizations for assistance with Canada goose damage. Resource owners choose to use whatever persons are available to assist them in their wildlife damage management efforts. This assistance may be available from WS, FWS, VDGIF, VDACS, local animal

control agencies, or private businesses or organizations. Volunteers may be attainable from local animal welfare and animal rights organizations who might provide information and/or assist in the implementation of certain management actions.

5.4.2 Community based decision making

5.4.2.1 Technical assistance provided by Wildlife Services to resource owners for decision making

The WS program in Virginia follows the "Co-managerial approach" to solve wildlife damage or conflicts as described by Decker and Chase (1997). Within this management model, WS provides technical assistance regarding the biology and ecology of Canada geese or ducks and effective, practical, and reasonable methods available to the local decision maker(s) to reduce wildlife damage. This includes nonlethal and lethal methods. Technical assistance on alleviating damage caused by resident Canada geese is available from VDACS and VDGIF also. WS and other state and federal wildlife or wildlife damage management agencies may facilitate discussions at local community meetings when resources are available. Resource owners and owners directly affected by goose or duck damage or conflicts in Virginia have direct input into the resolution of such problems. They may implement management recommendations provided by WS or others, or may request management assistance from WS, other wildlife management agencies, local animal control agencies, or private businesses or organizations.

Local decision makers decide which effective methods should be used to solve a wildlife-people conflict. These decision makers include community leaders, private property owners/managers, and public property owners/managers.

5.4.2.1.1 Community decision makers

The decision maker for the local community with a homeowner or civic association would be the President or the President's or Board's appointee. The President and Board are popularly elected residents of the local community who oversee the interests and business of the local community. This person would represent the local community's interest and make decisions for the local community or bring information back to a higher authority or the community for discussion and decision making. Identifying the decision maker for local business communities is more complex because the lease may not indicate whether the business must manage wildlife damage themselves, or seek approval to manage wildlife from the property owner or manager, or from a governing Board. WS would provide technical assistance to the local community or local business community decision maker(s) and recommendations to reduce damage. Direct control would be provided by WS if requested by the local community decision maker, funding provided, and the requested direct control was in line with WS recommendations.

5.4.2.1.2 Private property decision makers

The decision maker for private property owned by one person is him or herself. WS would provide technical assistance to this person and recommendations to reduce damage. Direct control would be provided by WS if requested, funding provided, and the requested direct control was in line with WS recommendations.

If no homeowner or civic association represents the affected resource owners of the local community then WS will provide technical assistance to the self or locally appointed decision maker. Direct control would be provided by WS if requested, funding provided, and the requested direct control was in line with WS recommendations. Additionally, a minimum of 67% of the affected resource owners must agree to the direct control action. If WS is working cooperatively with a state agency (VDGIF or VDACS) then the minimum percentage of resource owners agreeing to direct control may be higher because of state agency policy or practice. The affected resource owners would be those whose property is adjacent to the water body where the Canada geese or urban ducks primarily live. Affected resource owners who disagree with the direct control action may request WS not conduct this action on their property and WS will honor this request.

5.4.2.1.3 Public property decision makers

The decision maker for local, state, or federal property would be the official responsible for or authorized to manage the public land to meet interests, goals and legal mandates for the property. WS would provide technical assistance to this person and recommendations to reduce damage. Direct control would be provided by WS if requested, funding provided, and the requested direct control was in line with WS recommendations.

5.4.2.2 Decisions made by Wildlife Services, property owners, and others

VDACS, VDGIF, WS, and FWS evaluated and considered scenarios when specific population management action would be applied or offered. It was determined that:

1. In rural agricultural areas, population management methods that would be supported to alleviate agricultural, property, and natural resource damage are egg addling/oiling/puncturing/freezing, shooting to supplement harassment, and legal hunting.
2. In human health and/or safety situations (i.e. airports) and urban/suburban communities where the discharge of firearms is prohibited or considered unsafe, population management methods that would be supported are egg addling/oiling/puncturing/freezing and capture/euthanasia.
3. In urban/suburban communities in rural areas and public parks, shooting to supplement harassment and legal hunting will be supported if the discharge of firearms is safe, legal, and permitted by local government. City/county ordinances will be followed to define legal areas to discharge firearms. An additional population management method that would be supported is egg addling/oiling/puncturing/freezing.
4. In urban/suburban communities in rural areas and public parks where scenario 3 has been demonstrated ineffective or illegal, then the additional population management method that would be supported is capture/euthanasia.

5.4.2.3 Summary for community based decision making

This process for involving local communities and local stakeholders in the decisions for goose and duck damage management assures that local concerns are considered before individual damage management actions are taken.

Table 8. Methods potentially available to Wildlife Services for management of resident Canada goose and urban/suburban duck damage in Virginia.

Management methods	Resident Canada geese	Urban ducks
<u>Resource management</u>		
Alter habitat	A	A
Modify human behavior	A	A
Alter aircraft flight patterns	A	A
Create alternative habitat	A	A
Remove decoy waterfowl	A, B	A, B
<u>Physical exclusion</u>		
Wire grids	A, B	A, B
Perimeter fencing	A, B	A, B
Floating ball blanket	A, B	A, B
<u>Wildlife management</u>		
Frightening methods		
Guarding animals	A	A
Distress calls	A, B	ineffective
Pyrotechnics	A, B	A, B
Propane cannons	A, B	A, B
Reflective tape	A, B	A, B
Flags	A, B	A, B
Chemical repellents	A, B	A, B
Relocation	not allowed	not allowed
Contraception	not approved	not approved

Population reduction (lethal)			
Shooting to supplement harassment	A, B		A, B
Hunting	A		A
Nest/egg destruction	A, E		A, B
Capture and euthanasia	B		A, B
Chemical toxicants	not approved		not approved

A = primarily used by resource owners/managers

B = used by USDA-APHIS Wildlife Services personnel

6.0 ENVIRONMENTAL CONSEQUENCES

6.1 NO ACTION

6.1.1 Aesthetics

6.1.1.1 Impacts to resource owners receiving damage

Resource owners might strongly oppose this management alternative since they would bear the damage and costs caused by Canada geese and urban ducks. There may be high levels of frustration because of damage since WS would be providing no assistance which would eliminate the use of most lethal measures. The aesthetic value of ducks and geese would be low to none because the wildlife acceptance capacity has been exceeded and it appears there is no hope of reducing damage caused by high numbers of ducks and geese.

6.1.1.2 Impacts to stakeholders not receiving damage

The impacts of this alternative to stakeholders might be variable depending on their values towards wildlife and compassion for their neighbors. Animal activists and a minority of environmental activists might prefer this alternative because some animal activists believe it is morally wrong to kill or use animals for any reason and a minority of environmental activists believe migratory birds are protected by the MBTA from being killed under all circumstances. Also, some people may have formed bonds with particular ducks or Canada geese at particular locations. There will be increasing numbers of ducks and geese to view under this alternative.

6.1.1.3 Impacts to public not concerned with management actions

The uninformed and unaffected public would likely favor this alternative. The public will continue to observe ducks and geese in abundance. The aesthetic value of ducks and geese would diminish as more people are affected by damage at work, home, and recreational areas. As observations of numerous ducks and geese become more commonplace the aesthetic value will decline or be taken for granted. However, once the public is informed they are likely to reject this alternative.

6.1.1.4 Impacts to others

Waterfowl hunters may benefit from increased numbers of geese by taking less effort to fill the legally allowed daily bag.

6.1.2 Animal welfare

6.1.2.1 Concern among resource owners receiving damage

There would be concern among resource owners if other agencies, businesses, organizations, or people took action to capture, harass, or kill Canada geese and urban ducks. Resource owners would want the ducks and geese captured in a way which results in no pain or a minimum of pain which they would measure as physical injury (e.g., bleeding, broken wing). Additionally, captured birds should be made as comfortable as possible by feeding and watering the birds as necessary, not overcrowding the birds if birds are put in turkey crates or cages for transportation, and seeking shade for crated birds.

There would be concern among resource owners if harassed (e.g., pyrotechnics, dogs) adult geese and ducks became separated from goslings and ducklings. There would be concern among resource owners that the ducks and geese should be killed humanely, quickly, and without pain. If ducks or geese are shot, resource owners would want quick clean kills of shot birds. Most resource owners would have a passing interest if eggs were oiled, punctured, frozen, or addled.

6.1.2.2 Concern among stakeholders not receiving damage

The concerns among stakeholders not receiving damage would be similar as resource owners receiving damage. A minority of animal activists would want no ducks or geese being captured, harassed, or killed because they consider putting birds in crates inhumane, and most killing of birds as inhumane regardless of the method used to kill the ducks and geese. The only method of killing some animal activists would approve is chemical euthanasia of injured animals. Some animal activists would approve of oiling, freezing, puncturing, or adding eggs. If there are some people who believe they have developed affectionate bonds with individual geese or ducks, and if those particular geese and ducks end up being relocated or captured and euthanized, those individuals may very well feel sadness and perhaps anger. Thus, these individuals would be opposed to relocation or other forms of removing specific geese or ducks from a particular location.

6.1.2.3 Concern among the public not concerned with management actions

The concerns among the public not concerned with management actions would probably be the same as resource owners receiving damage.

6.1.3 Effects on human health and safety

6.1.3.1 Disease threat

The threat of disease to humans from contact with waterfowl fecal material would be expected to increase since the quantity of fecal material correspondingly would increase with a growing population of ducks and geese. People would be less willing to use recreational areas also used by ducks and geese because of the perceived increasing disease threat and the accumulation of filth. Some businesses (e.g., campgrounds) would have concerns that customers would go elsewhere because of the filth and perceived threat to human health. Some animal activists would claim there is no health threat. However, the Virginia Department of Health relies on monitoring to identify disease threats to humans and local doctors frequently treat the patients symptoms without identifying the cause. In addition, the Virginia Department of Health is conducting no investigations or studies to determine if there is a health threat to humans. Some disease (e.g., Cryptosporidium) which can be transmitted to people were only recently identified as a threat to human health by health officials. Some people will claim there is no health threat to people because the Centers for Disease Control website does not list any diseases caused by waterfowl. However, health threats from waterfowl are being listed on the Environmental Protection Agency website (e.g., Klett et al. 1995), health advisories are being published by local health officials, and agronomists, geneticists, and microbiologists are publishing information linking waterfowl to threats to human health (see Section 2.1.2). Finally, health officials are advising the public not to touch feces or to leave an area with excessive quantities of feces.

6.1.3.2 Threats to aviation

Threats to aviation and waterfowl-aircraft strikes would be expected to increase with increasing waterfowl populations. Anxiety among civil aviation pilots, airports, and passengers would increase because of increasing waterfowl populations and aircraft strikes. Anxiety among military pilots would be highest because of recent crashes and deaths caused by birds and this anxiety would increase because of increasing waterfowl populations.

6.1.3.3 Attacks on children and adults

Attacks on children and adults by Canada geese that believe goslings or eggs are threatened by humans who are too close to their goslings or eggs should increase because of increasing Canada goose populations which are increasingly using habitats used by humans. Most of the public would be frustrated that goose attacks on humans would be allowed to continue and at inaction by government which has management responsibility for waterfowl.

6.1.4 Biological impacts of management actions

6.1.4.1 Impacts on resident populations

Resident Canada geese and urban ducks would continue to increase in abundance over time where hunting pressure was low to non-existent. Some local populations of resident Canada geese would decline in abundance where hunting pressure was adequate.

Resource owners may kill or take illegal action against some local populations of Canada geese out of frustration of continued damage. This occurred at a golf course community in James City County during September 1993 where the golf course illegally put out Avitrol, a registered pesticide, to kill the Canada geese damaging the golf course (Sgt. Hickman, VDGIF, pers. comm.). A total of 39 Canada geese died from this action. This was an illegal taking of Canada geese and a misuse of an EPA registered pesticide.

6.1.4.2 Non-target species

Urban ducks would continue to be vectors of disease to other populations of urban ducks and wild ducks and geese. As the populations of urban ducks increased the risk of disease to wild waterfowl would be expected to increase.

6.1.4.3 Other biological impacts

None known.

6.1.5 Economic

6.1.5.1 Property losses

There will be increased damage to property from fecal droppings on recreational areas such as beaches, parks, and playgrounds. There will be increased damage to lawns and turf at homes, businesses, and golf courses.

6.1.5.2 Human health or safety losses or costs

There will be increased risk of disease from an increasing number of geese and ducks producing increasing amounts of fecal droppings which may have pathogens. Also, there should be an increased number of geese will increase the risk of goose - aircraft strikes to commercial and military aviation. There will be a greater incidence of attacks on children.

6.1.5.3 Agricultural losses

Agricultural losses to small grain, peanut, corn, livestock, and forage (hay) producers would continue to increase in those areas where hunting is limited by regulation or where few to no people hunt Canada geese.

6.1.5.4 Natural Resources

The potential to negatively affect water quality around beaches (recreational waters) and wetlands would increase because of the increasing amount of fecal droppings from an increasing goose population. Increased erosion from excessive grazing by Canada geese would negatively impact water quality and cause increased sedimentation.

6.1.5.5 Damage management costs

No fees would be paid to WS. However, fees would be paid to private pest control or nuisance wildlife control companies to assist the public with damage management.

6.1.6 Physical

The physical environment includes soil, water, and air.

6.1.6.1 Soil

There would be increased erosion along shorelines of ponds and lakes from excessive grazing by increasing numbers of Canada geese and ducks.

6.1.6.2 Water

There would be increased potential for long-term negative impacts related to fecal coliform contamination of surface drinking and recreational waters from an increasing resident Canada goose and urban duck populations.

6.1.6.3 Air

There would continue to be concern from citizens smelling excessive fecal droppings of Canada geese and urban ducks.

6.2 NON-LETHAL PROGRAM ONLY

6.2.1 Aesthetics

6.2.1.1 Impacts to resource owners receiving damage

Resource owners might oppose this management alternative since they would bear the damage and costs caused by Canada geese and urban ducks. There may be high levels of frustration because of damage since WS would be providing assistance which frequently is ineffective, is cost prohibitive, or moves the ducks and geese onto other resource owners property. The aesthetic value of ducks and geese would be low because the wildlife acceptance capacity has been exceeded and it appears there is little hope of reducing damage caused by high numbers of ducks and geese.

6.2.1.2 Impacts to stakeholders not receiving damage

Same as 6.1.1.2.

6.2.1.3 Impacts to public not concerned with management actions

The uninformed and unaffected public would likely favor this alternative. The public will continue to observe ducks and geese in abundance. The aesthetic value of ducks and geese would diminish as more people are affected by damage at work, home, and recreational areas. As observations of numerous ducks and geese become more commonplace the aesthetic value will decline or be taken for granted. However, once the public is informed, they are likely to reject this alternative because of the ineffectiveness of methods or that fact that harassment and exclusion simply move ducks and geese onto other peoples' property.

6.2.1.4 Impacts to others

Waterfowl hunters may benefit from increased numbers of geese by taking less effort to fill the legally allowed daily bag. Waterfowl hunters may benefit from increased numbers of ducks and geese forced to find alternative feeding and resting sites because of harassment at damage sites.

6.2.2 Animal welfare

6.2.2.1 Concern among resource owners receiving damage

While WS would only harass ducks and geese under this alternative, other agencies, businesses, organizations, or people may be able to capture, harass, or kill Canada geese and urban ducks. The concerns of resource owners would be the same as in 6.1.2.1.

6.2.2.2 Concern among stakeholders not receiving damage

The concern among stakeholders not receiving damage would probably be the same as in section 6.1.2.1, even though WS would be conducting nonlethal actions only.

6.2.2.3 Concern among the public not concerned with management actions

The concern among the public not concerned with management actions would be the same as resource owners receiving damage.

6.2.3 Effects on human health and safety

6.2.3.1 Disease threat

Same as 6.1.3.1 because Canada goose and urban ducks populations would continue to increase. Use of non-lethal methods may redistribute waterfowl to other areas without financial resources to get rid of the waterfowl, to other areas and waterfowl habituate to nonlethal methods leaving the resource owner with unwanted waterfowl, or to areas which tolerate more ducks and geese.

6.2.3.2 Threats to aviation

Same as 6.1.3.2. Nonlethal methods alone would have very little impact on managing threats to aviation because of the quantity of land areas and air space which must be affected to reduce waterfowl threats to aviation.

6.2.3.3 Attacks on children and adults

Same as 6.1.2.3.

6.2.4 Biological impacts of management actions

6.2.4.1 Impacts on resident populations

Same as 6.1.4.1

6.2.4.2 Non-target species

Same as 6.1.4.2

6.2.4.3 Other biological impacts

Same as 6.1.4.3

6.2.5 Economic

6.2.5.1 Property losses

There would be continued damage to property from fecal droppings on recreational areas such as beaches, parks, and playgrounds. There would be continued damage to lawns and turf at homes, businesses, and golf courses.

6.2.5.2 Human health or safety losses or costs

There will be continued risk of disease from an increasing number of geese and ducks producing increasing amounts of fecal droppings which may have pathogens thus health costs higher than necessary. Also, the increased number of geese will continue the risk of goose - aircraft strikes to commercial and military aviation will result in unnecessary repair costs..

6.2.5.3 Agricultural losses

Agricultural losses to small grain, peanut, corn, livestock, forage (hay) producers would continue in those areas where hunting is limited by regulation or few to no people hunt Canada geese.

6.2.5.4 Natural Resources

The potential to negatively affected water quality around beaches (recreational waters) and wetlands would continue because of the increasing amount of fecal droppings from an increasing goose population.

6.2.5.5 Damage management costs

Some fees would be paid to WS to implement non-lethal management programs to alleviate damage. Fees would also be paid to private pest control or nuisance wildlife control companies to assist the public with damage management. Some non-lethal methods are cost prohibitive or require so much labor to implement on a daily basis that the non-lethal program is not cost effective or reasonable.

6.2.6 Physical

The physical environment includes soil, water, and air.

6.2.6.1 Soil

There would be continued erosion along shorelines of ponds and lakes from excessive grazing by increasing numbers of Canada geese and ducks. Erosion of small lengths of shoreline could be lessen by using fencing to exclude the ducks and geese.

6.2.6.2 Water

There would be potential for continued long-term negative impacts related to fecal coliform contamination of surface drinking and recreational waters from an increasing resident Canada goose and urban duck populations.

6.2.6.3 Air

There would continue to be concern from citizens smelling excessive fecal droppings of Canada geese and urban ducks.

6.3 LETHAL PROGRAM ONLY

6.3.1 Aesthetics

6.3.1.1 Impacts to resource owners receiving damage

Resource owners would initially favor this alternative, however, some resource owners may become concerned in the future when there are fewer and fewer ducks and geese to observe on their property. Since the number of ducks or geese are within the wildlife acceptance capacity, resource owners would be more tolerant of damage involving ducks and geese. Most resource owners would not favor landscape scale (e.g., multiple county or regional) population reductions to alleviate damage even though this alternative would alleviate the most damage for the longest period of time and probably offer the greatest long-term cost-benefit of all the alternatives.

6.3.1.2 Impacts to stakeholders not receiving damage

Nearly all stakeholders would be very concerned with this alternative. Most stakeholders would strongly oppose and some stakeholders would vigorously oppose this alternative. Most animal activist would strongly oppose this alternative because they find it wrong to rely on killing wildlife to solve wildlife damage. There would be fewer ducks and geese to view in future years.

6.3.1.3 Impacts to public not concerned with management actions

The public would continue to observe ducks and geese, however in lower abundance. The aesthetic value of ducks and geese would increase as more local populations of ducks and geese fall within the wildlife acceptance capacity people find acceptable.

The public's ability to view and esthetically enjoy resident Canada geese or urban ducks at a particular pond or water body would be limited if the waterfowl were removed. Some new geese most likely would use the pond where geese were captured during the summer molt by late summer or early fall in northern, eastern, central, and extreme southwestern Virginia, although at lower densities than were present before the capture and euthanasia program. Ponds in other regions of Virginia where geese are captured during the summer molt would have some geese by late winter, although at much lower densities than were present before the capture and euthanasia. The opportunity to view ducks will occur when new birds colonize the water body or are released by someone. Thus, it is very difficult to predict the exact amount of time before a specific site would again have waterfowl present at that site. However, with approximately 300,000 non-migratory Canada geese presently residing in Virginia, the opportunity to view and enjoy Canada geese or urban ducks in numerous locations, including ponds, rivers, lakes retention basins or other bodies of water is plentiful. Viewing large numbers of Canada geese or urban ducks at a location would be limited. The opportunity to view urban or wild mallard ducks is available if a person makes the effort to visit ponds with adequate habitat.

6.3.1.4 Impacts to others

Waterfowl hunters would oppose this alternative since it may take more effort to legally harvest ducks and geese. Some waterfowl hunters may feel their hunting opportunity near an urban/suburban area or park were lessened because some resident Canada geese or urban/suburban ducks were captured and euthanized. Waterfowl hunters may benefit by harassment activities causing Canada geese to move which may expose them to hunting mortality.

6.3.2 Animal welfare

6.3.2.1 Concern among resource owners receiving damage

There would be concern among resource owners if WS, other agencies, businesses, organizations, or people took action to capture, harass, or kill Canada geese and urban ducks. Resource owners would want the ducks and geese captured in a way which results in no pain or a minimum of pain which they would measure as physical injury (e.g., bleeding, broken wing). Additionally, captured birds should be made as comfortable as possible by feeding and watering the birds as necessary, not overcrowding the birds if they are put in turkey crates or cages for transportation, and seeking shade for crated birds.

There would be concern among resource owners if harassed (e.g., pyrotechnics, dogs) adult geese and ducks became separated from goslings and ducklings. There would be concern among resource owners that the ducks and geese should be killed humanely, quickly, and without pain by the meat processor. There would be concern among resource owners that birds sedated with alpha chloralose should not be allowed to drown, even if the birds are to be euthanized. If ducks or geese are shot, resource owners would want quick clean kills of shot birds. Most resource owners would have an interest if eggs were oiled, punctured, frozen, or addled.

6.3.2.2 Concern among stakeholders not receiving damage

The concern among stakeholders not receiving damage would be similar as resource owners receiving damage. A minority of animal activists would want no ducks or geese being captured, harassed, or killed because they consider putting birds in crates inhumane, and most killing of birds as inhumane regardless of the method used to kill the ducks and geese. The only method of killing some animal activists would approve is chemical euthanasia of injured animals. Some animal activists would approve of oiling, freezing, puncturing, or addling eggs. If there are some people who believe they have developed affectionate bonds with individual geese or ducks, and if those particular geese and ducks end up being captured and euthanized, those individuals may very well feel sadness and perhaps anger. Thus, those individuals would be opposed to relocation or other forms of removing specific geese or ducks from a particular location.

6.3.2.3 Concern among the public not concerned with management actions

The concern among the public not concerned with management actions would be the same as resource owners receiving damage.

6.3.3 Effects on human health and safety

6.3.3.1 Disease threat

The threat of disease transmission from waterfowl to humans would decrease because humans would come in contact with fewer goose and duck droppings from a decreasing waterfowl population.

6.3.3.2 Threats to aviation

Threats to aviation would decrease because of decreasing abundance of ducks and Canada geese around airports and airbase and in flight paths.

6.3.3.3 Attacks on children and adults

Attacks on children and adults would decrease because of decreasing urban duck and Canada goose populations. Also, ducks and geese displaying aggressive behavior can be removed under this alternative to prevent an attack.

6.3.4 Biological impacts of management actions

6.3.4.1 Impacts on resident populations

Other resident Canada geese and urban ducks would be expected to fill the habitat made vacant by management actions over time. The amount of time to reoccupy the specific vacant habitat could range from a few months to a year, depending on the location within the state. Locations in northern Virginia where resident Canada geese are most numerous would be expected to have some resident Canada geese colonize the pond within one to three months after the molt or when other lethal management actions occur. Capture and euthanasia would result in no more than a 5% reduction of statewide population of Canada geese in a calendar year. Cumulative impacts of hunting, capture and euthanasia, and shooting to supplement harassment at a maximum would have reduced statewide populations of resident Canada geese by approximately 12% in 1997 if 5% of the resident population of resident Canada geese were captured and euthanized (Table 5 and 6). These cumulative impacts would not have any significant effect on the resident Canada goose population in Virginia. Over the last five years, except 1998, the statewide population of resident Canada geese has been increasing (Table 5). Moreover, the FWS in a 1998 EA stated that "... little overall population impact would be expected because many Canada goose populations have demonstrated the ability to sustain harvest rates in excess of 20 percent." It would be expected to take a few to several years for the waterfowl to return to the population levels which existed before capture and euthanasia, however, local populations would probably remain low but stable in number if lethal management was conducted on a regular basis.

6.3.4.2 Non-target species

There would be a small likelihood of sedating non-target wildlife with alpha chloralose. The Virginia WS program has placed treated bread baits for ducks and geese only to have coots (Fulica americana) steal the treated bait. The coots were captured and released the following day. The program has placed treated corn bait for ducks and had American crows (Corvus brachyrhynchos), a common grackle (Quiscalus quisaluis), and song sparrows (Melospiza melodia) take corn bait and become sedated. The birds recovered later that day and were released unharmed. Sometimes, ducks with plumage similar to wild mallards stole treated bread baits from target ducks. These wild mallards were then captured and released the following day upon recovery. A very small possibility exists for treated non-target birds to consume alpha chloralose bread baits and die. Woronecki et al. (1990) believed the use of alpha chloralose could be humanely used to capture waterfowl with a minimum of mortality and the sedation of non-target animals could be minimized by improved baiting techniques. The WS program would use caution when placing treated bread or corn baits to prevent the sedation and capture of non-target birds.

6.3.4.3 Other biological impacts

Population growth rate of resident Canada geese would be slowed or decline more under this alternative than other alternatives.

6.3.5 Economic

6.3.5.1 Property losses

There would be reduced property damage to affected resource owners.

6.3.5.2 Human health or safety losses or costs

There would be reduced risk of disease from a more stable number of geese and ducks producing fecal droppings which may have pathogens and thus lower health costs. Also, the stable number of geese would decrease the risk of goose - aircraft strikes to commercial and military aviation over previous alternatives would and would reduce repair costs.

6.3.5.3 Agricultural losses

Agricultural losses would decrease in those areas where hunting is limited by regulation or few to no people hunt Canada geese because fewer geese would be breeding or immigrating into under-occupied habitat.

6.3.5.4 Natural Resources

The potential to negatively affect water quality would decrease because of the stable or decreasing amount of fecal droppings from a stable or declining goose and duck population.

6.3.5.5 Damage management costs

Some fees would be paid to WS to implement lethal management programs to alleviate damage. Fees would also be paid to private pest control or nuisance wildlife control companies to assist the public with some lethal damage management methods such as egg oiling.

6.3.4 Physical

The physical environment includes soil, water, and air.

6.3.4.1 Soil

This alternative offers the likelihood of greatly reducing soil erosion because of the loss of shoreline vegetation due to grazing or pulling up of vegetation by waterfowl.

6.3.4.2 Water

This alternative offers the likelihood of greatly reducing contamination of water because of the reduction in waterfowl abundance and their fecal droppings.

6.3.4.3 Air

This alternative offers the likelihood of greatly reducing fecal odor in those few locations it is reported because of the reduction in waterfowl abundance and their fecal droppings.

6.4 INTEGRATED WILDLIFE DAMAGE MANAGEMENT PROGRAM (PROPOSED ACTION)

6.4.1 Aesthetics

6.4.1.1 Impacts to resource owners receiving damage

Resource owners would favor this alternative beyond all other alternatives because it provides the most options to reduce damage and the ability to choose among the most methods to craft solutions specific to their social and economic needs and wildlife acceptance capacity values. This alternative would be recognized for the most potential for long term positive impact.

6.4.1.2 Impacts to stakeholders not receiving damage

The impact to stakeholder would be highly variable and dependent largely on their values towards wildlife and compassion for people. Some stakeholders would see the need to let local communities manage damage caused by waterfowl, while other stakeholders (animal activists) would strongly oppose the need to manage damage and oppose letting local communities have the privilege of choosing most lethal management options. A minority of animal

activists would also oppose all damage management methods involving physical exclusion and wildlife management (Appendix D). A small minority of stakeholders (some but not all environmental activists) would oppose the need for lethal management of migratory birds for any reason.

6.4.1.3 Impacts to public not concerned with management actions

The impacts would be the same as expressed in section 6.3.1.3.

6.4.1.4 Impacts to others

The impacts would be the same as expressed in section 6.3.1.4.

6.4.2 Animal welfare

6.4.2.1 Impacts to resource owners receiving damage

Same as 6.3.3.1.

6.4.2.2 Impacts to stakeholders not receiving damage

Same as 6.3.3.2.

6.4.2.3 Impacts to public not concerned with management actions

Same as 6.3.3.3.

6.4.3 Effects on human health and safety

6.4.3.1 Disease threat

Same as 6.3.3.1.

6.4.3.2 Threats to aviation

Same as 6.3.3.2.

6.4.3.3 Attacks on children and adults

Similar as 6.3.3.3. Fewer geese would die under this alternative because integration of nonlethal and lethal methods would deter some geese from conflicting with people.

6.4.4 Biological impact of management actions

6.4.4.1 Impacts on resident populations

During state fiscal year 1997, unique and isolated situations arose where WS and VDACS cooperatively provided the capture and euthanasia method to the public in Virginia. The resulting impact was negligible on the resident Canada goose population. Of 331 requests for assistance received in 1997, WS recommended to capture and euthanize Canada geese in 18 situations, eight recommendations were made to shoot geese to supplement harassment, and 10 recommendations were made to oil eggs to reduce recruitment. The WS and VDACS program subsequently captured and euthanized 1,548 Canada geese, treated 285 Canada goose eggs with corn oil to prevent hatching, and removed two nests and eggs. The death of 1,548 Canada geese out of a statewide population of 301,000 in 1997 amounted to 0.51 percent (less than 1 percent) of the Canada goose population in Virginia. In 1998, with permission of U.S. District Court for the District of Columbia, WS captured and euthanized 100 resident Canada geese at Ronald Reagan National Airport and 55 resident Canada geese at Washington Dulles International Airport. The death of 155 resident Canada geese out of a statewide population of 254,000 in 1998 amounted to 0.0006%.

The removal of 5% or less of the statewide resident Canada goose population to alleviate damage or conflicts in Virginia would be insignificant to the statewide population. Capture and euthanasia would result in no more than a 5% reduction of statewide population of Canada geese in a calendar year. Cumulative impacts of hunting, capture and euthanasia, and shooting to supplement harassment at a maximum would have reduced statewide populations of resident Canada geese by approximately 12% in 1997 if 5% of the resident population of resident Canada geese were captured and euthanized (Table 5 and 6). These cumulative impacts would not have any significant affect on the resident Canada goose population in Virginia. Over the last five years, except 1998, the statewide population of resident Canada geese has been increasing (Table 5). Moreover, the FWS in a 1998 EA stated that "... little overall population impact would be expected because many Canada goose populations have demonstrated the ability to sustain harvest rates in excess of 20 percent." Removal of local populations of resident Canada geese may be temporally beneficial and removal would replace hunting mortality which is largely absent in urban/suburban areas because of local government restrictions on discharging firearms.

The impacts of direct control on local populations of urban ducks would be obvious since the objective most likely would be 100% removal and euthanasia. The statewide impact on urban ducks is unknown and insignificant to the wild resource since urban ducks are not biologically or behaviorally migratory waterfowl and they frequently must depend on man for their survival.

6.4.4.2 Non-target species

There is a small likelihood of sedating non-target wildlife with alpha chloralose. The Virginia Wildlife Services program has placed treated bread baits for ducks and geese only to have coots (*Fulica americana*) steal the treated bait. The coots were captured and released the following day. The program has placed treated corn bait for ducks and had American crows (*Corvus brachyrhynchos*), a common grackle (*Quiscalus quisqualis*), and song sparrows (*Melospiza melodia*) take corn bait and become sedated. The birds recovered later that day and were released unharmed. Sometimes, ducks with plumage similar to wild mallards steal treated bread baits from target ducks. These wild mallards are then captured and released the following day upon recovery. A very small possibility exists for treated non-target birds to consume alpha chloralose bread baits and die. Woronecki (1992) found of 587 waterfowl sedated with alpha chloralose 0% of geese and 8% of ducks captured during field trials died. Woronecki et al. (1990) believed the use of alpha chloralose could be humanely used to capture waterfowl with a minimum of mortality and the sedation of non-target animals could be minimized by improved baiting techniques. The WS program will use caution when placing treated bread or corn baits to prevent the sedation and capture of non-target birds.

6.4.4.3 Other biological impacts

Other biological impacts are insignificant. For example, there may be fewer goose and duck eggs for raccoons living in urban areas to eat during the spring time. However, this reduction in eggs would be expected to have no impact on the survival of raccoons. Migratory populations of mallard ducks and other migratory ducks would be unaffected by this alternative.

6.4.5 Economic

The overall economic effect would be a reduction in costs caused by damage or implementation of control programs. Some businesses have hired employees to reduce damage by implementing harassment programs or clean walkways daily or weekly. The reduction in damage may reduce the need for employees which would lessen business costs and may cause an employee to lose a job. There would also be the expected reduction in sales of harassment devices and services offered by pest control or nuisance wildlife control companies.

6.4.5.1 Property losses

There would be a reduction in costs to replace damaged turf from lawns and golf courses. There would be a reduction in costs to inspect aircraft struck by geese and to repair airplane engines, wings, and radomes.

6.4.5.2 Human health or safety losses or costs

There would be a reduction in the threat to human safety because the number of geese flying in airspace around airports and military bases would be reduced. There would also be a reduction in risk of exposure to pathogens from waterfowl because the number of waterfowl and their fecal droppings would be reduced.

6.4.5.3 Agricultural losses

There would be some reduction in losses to agriculture from grazing of cereal grains, peanuts, and other crops, and competition for forage between geese and livestock producers under this alternative. There would be some reduction in losses from pulling of corn, soybean, and other sprouts. The risk of disease from elevated fecal coliform bacteria and other pathogens to livestock drinking contaminated water or dairy cattle laying in feces would be reduced.

6.4.5.4 Natural Resources

Water quality would be improved and fecal coliform bacteria reduced because of the reduction in the quantity of feces entering or pathogens seeping from feces into surface water.

6.4.5.5 Damage management costs

The cost to manage damage would decrease. This would include the cost of managing the resource being affected, physical exclusion, and wildlife management (Appendix I).

6.4.6 Physical

The physical environment includes soil, water, and air.

6.4.6.1 Soil

This alternative offers the best likelihood of reducing or eliminating soil erosion because of the loss of shoreline vegetation due to grazing or pulling up of vegetation by waterfowl.

6.4.6.2 Water

This alternative offers the best likelihood of reducing contamination of water because of the reduction in waterfowl

abundance and their fecal droppings.

6.4.6.3 Air

This alternative offers the best likelihood of reducing fecal odor in those few locations it is reported because of the reduction in waterfowl abundance and their fecal droppings.

Table 9. A Comparison of Impacts of Alternatives Considered in this Environmental Assessment

IMPACTS	ALTERNATIVE 1 (NO ACTION)	ALTERNATIVE 2 (NONLETHAL PROGRAM ONLY)	ALTERNATIVE 3 (LETHAL PROGRAM ONLY)	ALTERNATIVE 4 (INTEGRATED WILDLIFE DAMAGE MANAGEMENT PROGRAM)
AESTHETICS				
To resource owners receiving damage	Would likely strongly oppose this management alternative due to continued damage.	Would likely favor this alternative over a no action alternative, but prefer a more aggressive approach.	Would not likely favor a large scale population reduction even though it would help to alleviate damage.	Would likely strongly favor this alternative. Alternative would be recognized as having the most potential for long-term positive impact.
To stakeholders not receiving damage	Some stakeholders would likely strongly favor this management alternative, if it amounted to a "hands off" approach to wildlife. However, others might remove waterfowl by relocation or killing.	Some stakeholders would likely favor this management alternative over lethal measures of wildlife management.	Would likely be strongly opposed to this management alternative, especially those with affectionate bonds. Generally, some strongly opposed to killing of wildlife.	Would likely be variable to this management alternative. Some not in favor of active management of wildlife would oppose this alternative.
To public not concerned with management actions	Uninformed public would likely favor this alternative. Once informed, not likely to favor this alternative. Public will continue to observe geese and ducks in abundance.	Uninformed public would likely favor this alternative. Once informed, may or may not favor this alternative. Public will continue to observe geese and ducks in abundance.	Public not likely to favor a program which focuses solely on the killing of wildlife. Public ability to view and aesthetically enjoy resident Canada geese and urban ducks at a particular water body will be somewhat limited.	Uninformed public would likely not favor this alternative. Once informed, likely to strongly favor this alternative. Public ability to view and aesthetically enjoy resident Canada geese and urban ducks at a particular water body will be temporarily limited.

IMPACTS	ALTERNATIVE 1 (NO ACTION)	ALTERNATIVE 2 (NONLETHAL PROGRAM ONLY)	ALTERNATIVE 3 (LETHAL PROGRAM ONLY)	ALTERNATIVE 4 (INTEGRATED WILDLIFE DAMAGE MANAGEMENT PROGRAM)
Impacts on others	Waterfowl hunters may benefit by the increased number of ducks and geese available for legal harvest.	Waterfowl hunters may benefit by the increased number of ducks and geese available for legal harvest.	Waterfowl hunters may see fewer ducks and geese available for legal harvest near urban/suburban areas.	Same impacts as Alternative 3.
ANIMAL WELFARE				
Concern among resource owners receiving damage	Concern of actions of others separates adults from juveniles. Would want ducks and geese killed humanely. Would be upset if birds wounded when shot by others.	Concern if WS harassment actions separate adults from goslings.	Want ducks and geese captured in such a way which results in no pain or minimum of pain. Wants birds treated humanely during transportation, holding, and processing for human consumption.	Same as Alternative 3.
Concern among stakeholders not receiving damage	Same concerns as resource owners. Animal activists would oppose killing of ducks and geese by other agencies, businesses, organizations, or people.	Same as Alternative 1.	Same concerns as resource owners except some animal activists believe capture and killing ducks and geese is inhumane regardless of methods used.	Same as Alternative 3.
Concern among the public not concerned with management actions	Same as resource owners	Same as alternative 1.	Same concerns as resource owners.	Same as Alternative 3.
EFFECTS ON HUMAN HEALTH AND SAFETY				

IMPACTS	ALTERNATIVE 1 (NO ACTION)	ALTERNATIVE 2 (NONLETHAL PROGRAM ONLY)	ALTERNATIVE 3 (LETHAL PROGRAM ONLY)	ALTERNATIVE 4 (INTEGRATED WILDLIFE DAMAGE MANAGEMENT PROGRAM)
Disease threat	The threat of disease would continue to increase because waterfowl abundance continues to increase. Public anxiety about disease threat increases.	Public still anxious about disease threat but less so because action taken to alleviate threat.	Public anxiety about disease threat greatly reduced because of visible reduction of droppings due to fewer ducks and Canada geese.	Same as Alternative 3.
Threats to aviation	Increasing threat of waterfowl-aircraft strikes	Slower increasing threat of waterfowl-aircraft strikes	Reduction of threat of waterfowl-aircraft strikes	Greatest reduction of threat of waterfowl-aircraft strikes because practical and effective nonlethal and lethal methods used
Attacks on children and adults	Increased number of attacks on people.	Same as Alternative 1.	Reduction or elimination of attacks on people.	Reduction or elimination of attacks on people. Fewer geese would die under this alternative.
BIOLOGICAL IMPACTS OF MANAGEMENT ACTIONS				

IMPACTS	ALTERNATIVE 1 (NO ACTION)	ALTERNATIVE 2 (NONLETHAL PROGRAM ONLY)	ALTERNATIVE 3 (LETHAL PROGRAM ONLY)	ALTERNATIVE 4 (INTEGRATED WILDLIFE DAMAGE MANAGEMENT PROGRAM)
On resident Canada geese and urban ducks	Resident Canada geese and urban ducks would continue to increase in abundance. Possible illegal action may be taken against birds.	Same as Alternative 1	Other ducks and Canada geese will fill habitats over time made vacant by management actions. Populations would remain low locally if management actions conducted annually.	Would be expected to slow the population growth rate of resident Canada geese in urban and suburban areas. No more than 5% of the statewide population of resident Canada geese will be killed with capture/euthanasia in a calendar year, unless authorized by VDGIF to meet population goals.
On non-target species	Urban ducks would increasingly be vectors of disease to other waterfowl.	Same as Alternative 1.	Small likelihood of sedating non-target species with Alpha chloralose. Non-target species would be released unharmed after recovery.	Same as Alternative 3.
ECONOMIC				
Property loss	Increased damage to property including fecal droppings on recreational areas and feeding damage to lawns and golf courses.	Continued damage to property including fecal droppings on recreational areas and feeding damage to lawns and golf courses.	Reduced property damage for affected resource owners.	Reduced property damage for affected resource owners.
Human health or safety losses or costs	Increased costs for health, for repair of aircraft, and for businesses losing customers.	Similar to Alternative 1. Costs may be slightly lower.	Costs would be reduced.	Greatest reduction in costs.

IMPACTS	ALTERNATIVE 1 (NO ACTION)	ALTERNATIVE 2 (NONLETHAL PROGRAM ONLY)	ALTERNATIVE 3 (LETHAL PROGRAM ONLY)	ALTERNATIVE 4 (INTEGRATED WILDLIFE DAMAGE MANAGEMENT PROGRAM)
Agricultural losses	Increased agricultural losses to farmers as a result of goose grazing and sprout pulling. Increased potential for geese to spread disease to livestock.	Continued agricultural losses to farmers as a result of goose grazing and sprout pulling. Continued potential for geese to spread disease to livestock.	Reduced agricultural losses to farmers as a result of goose grazing and sprout pulling. Reduced potential for geese to spread disease to livestock.	Reduced agricultural losses to farmers as a result of goose grazing and sprout pulling. Reduced potential for geese to spread disease to livestock.
Natural resources	Increased potential for geese to negatively affect water quality around beaches and in wetlands.	Continued potential for geese to negatively affect water quality around beaches and in wetlands.	Reduced potential for geese to negatively affect water quality around beaches and in wetlands.	Reduced potential for geese to negatively affect water quality around beaches and in wetlands.
Damage management costs	No management fees would be charged by Wildlife Services. Resource owners/managers could pay private pest control businesses for damage management assistance. Damage management costs would increase.	Resource owners/managers could hire Wildlife Services for assistance in implementing nonlethal damage management methods or pay private pest control businesses for some lethal damage management assistance. Damage management costs continue to increase.	Resource owners/managers could hire Wildlife Services for lethal management of Canada geese and urban ducks or private pest control businesses for some lethal or non-lethal damage management assistance. Some reduction in damage management costs. Reduction in costs would increase over years as birds become lower in abundance.	Resource owners/managers could hire Wildlife Services or private pest control businesses for lethal or non-lethal implementation of damage management assistance. Cost would decrease the most under this alternative because of an integration of methods.
PHYSICAL				

IMPACTS	ALTERNATIVE 1 (NO ACTION)	ALTERNATIVE 2 (NONLETHAL PROGRAM ONLY)	ALTERNATIVE 3 (LETHAL PROGRAM ONLY)	ALTERNATIVE 4 (INTEGRATED WILDLIFE DAMAGE MANAGEMENT PROGRAM)
Soil	Potential for increased erosion along certain shorelines due to grazing on shoreline vegetation by excessive numbers of Canada geese and ducks.	Potential for continued erosion along certain shorelines due to grazing on shoreline vegetation by excessive numbers of Canada geese and ducks.	Potential for reduced erosion along certain shorelines due to grazing on shoreline vegetation by excessive numbers of Canada geese and ducks.	Potential for reduced erosion along certain shorelines due to grazing on shoreline vegetation by excessive numbers of Canada geese and ducks.
Water	Potential for increased long-term negative impacts related to fecal contamination of water sources which are populated with large numbers of Canada geese and ducks.	Potential for continued long-term negative impacts related to fecal contamination of water sources which are populated with large numbers of Canada geese and ducks.	Potential for reduced long-term negative impacts related to fecal contamination of water sources which are populated with large numbers of Canada geese and ducks.	Potential for reduced long-term negative impacts related to fecal contamination of water sources which are populated with large numbers of Canada geese and ducks.
Air	Continued long-term concern related to airborne odor from Canada goose droppings.	Continued long-term concern related to airborne odor from Canada goose droppings.	Potential reduction in long-term concern related to airborne odor from Canada goose droppings.	Potential reduction in long-term concern related to airborne odor from Canada goose droppings.

7.0 THREATENED AND ENDANGERED SPECIES AND NON-TARGET WILDLIFE

Terwilliger (1991) and Terwilliger and Tate (1995), and the U.S. Fish and Wildlife Service's list of federal endangered or threatened species for Virginia (www.fws.gov/r9endspp/statl-r5.html) were reviewed to make a determination of whether any might be affected by the proposed action. The only methods described in the proposed action that could be employed by WS and which have the potential for nontarget take are goose and duck panel traps used during the June-July molting period and the oral tranquilizer drug alpha chloralose. The only nontarget species captured during goose or duck panel trapping activities in the past have been domestic ducks and geese which were released unharmed. Some nontarget wildlife (coots, crows, grackles, sparrows) have been taken with alpha chloralose but were also released unharmed upon recovery (see section 6.4.4.2). A formal risk assessment of WS methods showed no probable risk from primary (i.e., from ingestion of A-C treated baits) or secondary (i.e., from scavenging on birds that have eaten A-C treated baits) exposure to alpha chloralose, and determined no hazards to water resources (USDA 1994: Appendix P, p. 181 - 184). Based on the above analysis, WS has determined that the proposed action would have no effect on any listed species.

8.0 ENVIRONMENTAL JUSTICE

Executive Order 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations requires Federal agencies to analyze disproportionately high and adverse environmental effects of proposed actions on minority and low-income populations. WS has analyzed the effects of the proposed action and determined that implementation of the preferred alternative would not have adverse human health or environmental impacts on low-income or minority populations. None of the existing problem areas are located near predominately low-income or minority populations. WS would not be responsible for processing or distributing for human consumption the Canada geese or ducks taken in this action. That responsibility would rest with decision makers who have agreed to donate the meat to needy individuals or charitable organizations for distribution to low-income populations in accordance with all State health regulations.

9.0 NATIONAL HISTORIC PRESERVATION ACT (NHPA) OF 1966 AS AMENDED

The National Historic Preservation Act (NHPA) of 1966, and its implementing regulations (36 CFR 800), requires federal agencies to: 1) determine whether activities they propose constitute "undertakings" that can result in changes in the character or use of historic properties and, 2) if so, to evaluate the effects of such undertakings on such historic resources and consult with the State Historic Preservation Office regarding the value and management of specific cultural, archaeological and historic resources, and 3) consult with appropriate American Indian Tribes to determine whether they have concerns for traditional cultural properties in areas of these federal undertakings. WS actions on tribal lands are only conducted at the tribe's request and under signed agreement; thus, the tribes have control over any potential conflict with cultural resources on tribal properties. WS activities as described under the proposed action do not cause ground disturbances nor do they otherwise have the potential to significantly affect visual, audible, or atmospheric elements of historic properties and are thus not undertakings as defined by the NHPA. Harassment techniques that involve noise-making could conceivably disturb users of historic properties if they were used at or in close proximity to such properties; however, it would be an exceedingly rare event for noise-producing devices to be used in close proximity to such a property unless the resource being protected from bird damage was the property itself, in which case the primary effect would be beneficial. Also, the use of such devices is generally short term and could be discontinued if any conflicts with historic properties arose.

10.0 LITERATURE CITED

- Aguilera, E., R. L. Knight, and J. L. Cummings. 1991. An evaluation of two hazing methods for urban Canada geese. *Wildl. Soc. Bull.* 19:32-35
- Allen, H. A., D. Sammons, R. Brinsfield, and R. Limpert. 1985. The effects of Canada goose grazing on winter wheat: an experimental approach. *Proc. Second Eastern Wildlife Damage Control Conf.* 2:135-141
- Allin, C. C., G. G. Chasko, and T. P. Husband. 1987. Mute swans in the Atlantic Flyway: A review of the history, population growth and management needs. *Trans. NE. Sect. Wildl. Soc.* 44:32-47
- Amundson, D. A. 1988. Organochlorine pesticides and PCBs in edible tissues of giant Canada geese from the Chicago area. M.S. Thesis, Univ. of Ill. Chicago. 98pp.
- Ankney, C. D. 1996. An embarrassment of riches: too many geese. *J. Wildl. Manage.* 60:217-223
- Anderson, W. 1998. Geese turning Lake Lanier into fowl territory. *The Atlanta Journal-Constitution*. June 18. Atlanta, GA.
- Anonymous. 1992. Airports - breeding grounds for bird strikes. Flight Safety Foundation. Airport Operations Vol. 18., No. 4. Arlington, VA. 4p.
- Anonymous. 1998. Can bacteria in water make me sick? Cooperative Extension Service, Ohio State University. 2 p.
- Anonymous. 1998. Scientist able to pinpoint E. coli source. *Richmond Times-Dispatch*. August 16, 1998.
- Avery, M. L. 1994. Finding good food and avoiding bad food: does it help to associate with experienced flockmates?. *Anim. Behav.* 48:1371-1378
- Barrett, E. 1996. Crecarial dermatitis, Virginia 1996. Pages 4 -5 In *Epidemiology Bulletin*. Virginia Department of Health. August.
- Belant, J. L., T. W. Seamans, L. A. Tyson, and S. K. Ickes. 1996. Repellency of methyl anthranilate to pre-exposed and naive Canada geese. *J. Wildl. Manage.* 60:923-928.
- Bellrose, F. C. 1976. Ducks, geese, and swans of North America. Stackpole books. Harrisburg, PA. 543 p.
- Berryman, J. H. 1991. Animal damage management: responsibilities of various agencies and the need for coordination and support. *Proc. East. Wildl. Damage Control Conf.* 5:12-14.
- Bishop, R. C. 1987. Economic values defined. Pages 24 -33 in D. J. Decker and G. R. Goff, eds. *Valuing wildlife: economic and social perspectives*. Westview Press, Boulder, CO. 424 p.
- Booth, T. W. 1994. Bird dispersal techniques. Pages E-19 to E-23 In *Prevention and control of wildlife damage*. Edited by S.E. Hygnstrom, R. M. Timm, and G. E. Larson. Univ. of Nebraska.
- Brand, C. J. 1987. Duck Plague. Pages 117-127 In *Field Guide to wildlife diseases*. M. Friend and C. J. Laitman editors. 225 p.
- Bruggers, R. L., J. E. Brooks, R. A. Dolbeer, P. P. Woronecki, R. K. Pandit, T. Tarimo, All-India, M. Hoque. 1986. Responses of pest birds to reflecting tape in agriculture. *Wildl. Soc. Bull.* 14:161-170.

- Cagle, S. 1998. Four streams tagged for water quality. June 11. Roanoke Times. Roanoke, VA.
- Centers for Disease Control and Prevention. 1995. Cryptosporidiosis: Fact Sheet. Nat. Center for Infect. Dis. 3 p.
- Centers for Disease Control and Prevention. 1998. Giardiasis. Nat. Center for Infect. Dis. 3 p.
<http://www.cdc.gov/ncidod/dpd/giardias.htm>
- Chasko, G. G. 1986. The impact of mute swans on waterfowl and waterfowl habitat. Conn. Dept. of Environ. Prot. Final Rep. Fed. Aid. Proj. W-49-R-10-509.
- Cleary, E. C., S. E. Wright, and R. A. Dolbeer. 1997. Wildlife strikes to civil aircraft in the United States, 1992 - 1996. DOT/FAA/AS/97-3. FAA. Washington, D.C. 30p.
- Colley, D. G. 1996. Waterborne Cryptosporidiosis threat addressed. Centers for Disease Control and Prevention. Atlanta, GA. <http://www.cdc.gov/ncidod/EID/vol1no2/colley.htm>
- Conomy, J. T., J. A. Collazo, I. A. Dubovsky, and W. J. Fleming. 1998. Dabbling duck behavior and aircraft activity in coastal North Carolina. J. of Wildl. Manage. 62:1127-1134
- Conover, M. R. 1991. Reducing nuisance Canada goose problems through habitat manipulation. Proc. Great Plains Wildl. Damage Conf. 10:146 (abstract only)
- Conover, M. R. 1992. Reducing nuisance Canada goose problems through habitat manipulation. Proc. East. Wildl. Damage Control Conf. 5:33 (abstract only)
- Conover, M. R. and G. G. Chasko. 1985. Nuisance Canada geese problems in the eastern United States. Wildl. Soc. Bull. 13:228-233.
- Conover, M. R. and R. A. Dolbeer. 1989. Reflecting tapes fail to reduce blackbird damage to ripening cornfields. Wildl. Soc. Bull. 17:441-443
- Conover, M. R. and G. S. Kania. 1991. Characteristics of feeding sites used by urban-suburban flocks of Canada geese in Connecticut. Wildl. Soc. Bull. 19:36-38.
- Conover, M. R. and G. S. Kania. 1994. Impact of interspecific aggression and herbivory by mute swans on native waterfowl and aquatic vegetation in New England. Auk 111:744-748
- Converse, K. A. and J. J. Kennelly. 1994. Evaluation of Canada goose sterilization for population control. Wildl. Soc. Bull. 22:265-269
- Cooper, J. A. 1995. The potential health hazards of consuming Metropolitan Twin Cities Canada geese. Unpublished report. 6pp.
- Cooper, J. A. and T. Keefe. 1997. Urban Canada goose management: policies and procedures. Trans. 62nd No. Am. Wildl. and Natural Resour. Conf 62:412-430
- Costanzo, G. R. 1993. Birds of a feather don't always flock together. Virginia Wildlife 54:4-8
- Costanzo, G. R. 1994. Report on the September 1994 Canada goose hunting season in Virginia. VA Dept. Of Game and Inland Fish. Wildl. Res. Bull. 94-7. 7pp.

- Costanzo, G. R., R. A. Williamson, and D. E. Hayes. 1995. An efficient method for capturing flightless geese. *Wildl. Soc. Bull.* 23:201-203
- Cummings, J. L., M. E. Pitzler, P. A. Pochop, H. W. Krupa, T. L. Pugh, and J. A. May. 1997. Field evaluation of white mineral oil to reduce hatching in Canada goose eggs. Thirteenth Great Plains Wildl. Damage Control Workshop Proc. 13:67-72
- Cummings, J. L., P. A. Pochop, J. E. Davis Jr., and H. W. Krupa. 1995. Evaluation of Rejex-It AG-36 as a Canada goose grazing repellent. *J. Wildl. Manage.* 59:47-50
- Davidson, W. R. and V. F. Nettles. 1997. Field Manual of Wildlife Diseases in the Southeastern United States. 2nd edition. Southeastern Cooperative Wildlife Disease Study. Univ. of Ga. Athens, GA. 417 p.
- Decker, D. J. and L. C. Chase. 1997. Human dimensions of living with wildlife - a management challenge for the 21st century. *Wildl. Soc. Bull.* 25:788 - 795
- Decker, D. J. and G. R. Goff. 1987. Valuing Wildlife: Economic and Social Perspectives. Westview Press. Boulder, Colorado, p. 424.
- Decker, D. J. and K. G. Purdy. 1988. Toward a concept of wildlife acceptance capacity in wildlife management. *Wildl. Soc. Bull.* 16:53-57
- Dolbeer, R. A., P. P. Woronecki, and R. L. Bruggers. 1986. Reflecting tapes repel blackbirds from millet, sunflowers, and sweet corn. *Wildl. Soc. Bull.* 14:418-425
- Doster, G. L. 1998. Bovine Coccidiosis not linked to geese. Southeastern cooperative wildlife disease study briefs. Univ. Of Georgia. Athens, GA 4: 2-3
- Fairaizl, S. D. 1992. An integrated approach to the management of urban Canada geese depredations. *Verteb. Pest. Conf.* 15:105-109
- Fairaizl, S. D. and W. K. Pfeifer. 1988. The lure crop alternative. Great Plains Wildlife Damage Control Workshop 8:163-168
- Feachem, R. G., D. J. Bradley, J. Garelick, and D. D. Mara. 1983. Sanitation and disease health aspects of excreta and waste water management. Pitman Press. Great Britain. 501 p.
- Gallien, P. and M. Hartung. 1994. *Escherichia coli* O157:H7 as a food borne pathogen. Pages 331-341 in Handbook of zoonoses. Section A: bacterial, rickettsial, chlamydial, and mycotic. G. W. Beraz and J. H. Steele, eds. CRC Press. Boca Raton.
- Graczyk, T. K., R. Fayer, J. M. Trout, E. J. Lewis, C. A. Farley, I. Sulaiman, and A. A. Lal. 1998. *Giardia* sp. Cysts and infections *Cryptosporidium parvum* oocysts in the feces of migratory Canada geese. *Applied and Environmental Microbiology.* 64:2737-2738.
- Heinrich, J. W. and S. R. Craven. 1990. Evaluation of three damage abatement techniques for Canada geese. *Wildl. Soc. Bull.* 18:405-410
- Hestbeck, J. B. 1994. Survival rates of Canada geese. *J. Wildl. Manage.* 58:748-756

- Hestbeck, J. B. 1995. Population study and management of Atlantic Flyway Canada geese. *J. of Applied Statistics*. 22:877-890.
- Hoffler, D. F. 1974. Cercarial Dermatitis: Its etiology, epidemiology, and clinical aspects. *Arch Environ. Health*. 29:225-229
- Jamieson, R. L. 1998. Tests show Canada geese are cause of polluted lake water. *Seattle Pilot*. July 9. Seattle, WA.
- Johnson, F. A. and P. M. Castelli. unpublished. Demographics of Canada geese breeding in southeastern Canada and the Northeastern U.S. 16 p.
- Kadlec, J. A. 1968. Bird reactions and scaring devices. Append. 1. *Fed. Aviation Advis. Circ.* 150-5200-9
- Kennamer, J. E., M. Kennamer, and R. Brenneman. 1992. History. Pages 6 - 17 *In* The wild turkey: biology and management. J. C. Dickson, ed. Stackpole Books. Harrisburg, PA. 463 p.
- Klett, B. R., D. F. Parkhurst, and F. R. Gaines. 1998. The Kensico Watershed Study: 1993 - 1995. <http://www.epa.gov/owowwtrl/watershed/Proceed/klett.html>
- Kramer, M. H., B. L. Herwaldt, G. F. Craun, R. L. Calderon, and D. D. Juranek. 1996. Surveillance for waterborne-disease Outbreaks - United States, 1993-1994. *Morbidity and Mortality Weekly Report*. U.S. Dept. Of Health and Human Services, Public Health Service. Atlanta, GA. 33 p.
- Leopold, A. S. 1933. *Game Management*. Charles Scribner & Sons. NY, NY. 481 p.
- Locke, L. N. 1987. Chlamydiosis. Pages 107-113 *In* Field guide to wildlife diseases. M. Friend and C. J. Laitman editors. 225 p.
- Lowney, M. S. 1993. Excluding non-migratory Canada geese with overhead wire grids. *Proc. East. Wildl. Damage Contr. Conf.* 6:85-88.
- Mason, J. R., L. Clark, and P. S. Shah. 1991. Ortho-aminoacetophenone repellency to birds: similarities to methyl anthranilate. *J. Wildl. Manage.* 55:334-340.
- Mason, J. R. and L. Clark. 1994. Evaluation of plastic and mylar flagging as repellents for snow geese (*Chen caerulescens*). *Crop Protection* 13:531-534
- Mason, J. R., L. Clark, and N. J. Bean. 1995. White plastic flags repel snow geese (*Chen caerulescens*). *Crop Protection* 13:497-500
- Meffe, G. K. 1986. Conservation genetics and the management of endangered fishes. *Fisheries* 11:14-23.
- Mott, D. F. and S. K. Timbrook. 1988. Alleviating nuisance Canada goose problems with acoustical stimuli. *Proc. Vertebr. Pest. Conf.* 13:301-305
- Nielsen, L. 1988. Definitions, considerations, and guidelines for translocation of wild animals. Pages 12-49 *In* Translocation of Wild Animals. Edited by L. Nielsen and R. D. Brown. WI Humane Society, Inc. and Ceaser Kleberg Wildlife Research Instit. 333 p.
- Rabenold, P. P. 1987. Recruitment to food in black vultures: evidence for following from communal roosts. *Anim. Behav.* 35:1775-1785

- Roffe, T. J. 1987. Avian tuberculosis. Pages 95-99 In Field guide to wildlife diseases. M. Friend and C. J. Laitman editors. 225 p.
- Samadpour, M. 1998. Microbial source tracking identification of the sources of microbial pollution in the environment. 90th Annual Meeting. Amer. Soc. of Agronomy. Baltimore. Oct. 18 - 22.
- Schmidt, R. H. 1989. Animal welfare and wildlife management. Trans. N. A. Wildl. And Nat. Res. Conf. 54:468-475
- Shen, F. 1998. Collies corral golfers' goose problem. June 4. Washington Post. Washington, D. C.
- Simmons, G. M., S. A. Herbein, and C. M. James. 1995. Managing nonpoint fecal coliform sources to tidal inlets. Water Resources Update. 100:64-74
- Simmons, G. M. and S. A. Herbein. 1998. Identifying nonpoint fecal coliform sources in tidal creeks of the Chesapeake Bay. (Abstract). Protecting land, water, and biological resources. 90th Annual Meet. American Society of Agronomy. Oct. 20.
- Smith, K. E., J. R. Fischer, S. E. Little, J. M. Lockhart, and D. E. Stallknecht. 1997. Diseases with implication for human health. Pages 378-399 In Field Manual of Wildlife Diseases in the Southeastern United States. W. R. Davidson and V. F. Nettles, eds. Univ. of GA. Athens, GA.
- Shultz, D. F., J. A. Cooper, M. C. Zicus. 1988. Fall flock behavior and harvest of Canada geese. J. of Wildl. Manage. 52:679-688
- Smith, A. E., S. R. Craven, and P. D. Curtis. 1999. Managing Canada geese in urban environments. Jack Berryman Institute Publication 16. and Cornell University Cooperative Extension, Ithaca, N. Y. p. 42.
- Sterritt, R. M. and J. N. Lester. 1988. Microbiology for environmental and public health engineers. E. & F. N. Spon, pub. New York
- Stroud, R. K. And M. Friend. Salmonellosis. Pages 101-106 In Field guide to wildlife diseases. M. Friend and C. J. Laitman editors. 225 p.
- Swift, B. L. 1998. Response of resident Canada geese to chasing by trained border collies. Unpub. report. NY Dept. C Environ. Conser. Delmar, NY. 6p.
- Terwilliger, K. 1991. Virginia's Endangered Species: Proceedings of a symposium. McDonald and Woodward Publ. Blacksburg, VA 638 p.
- Terwilliger K. and J. R. Tate. 1995. A guide to endangered and threatened species in Virginia. McDonald and Woodward Publ. Blacksburg, VA. 220 p.
- Tobin, M. E., P. P. Woronecki, R. A. Dolbear, R. L. Bruggers. 1988. Reflecting tape fails to protect ripening blueberries from bird damage. Wildl. Soc. Bull. 16:300-303
- Trice, C. R. 1999. Entire flock of diseased turkeys killed. Richmond Times Dispatch. January 27, 1999.
- Trice, C. R. 1999a. Cooperation on avian flu earns praise. Richmond Times Dispatch. January 31, 1999.
- Upcroft, J. A., P. A. McDonnell, A. N. Gallagher, N. Cheng, and P. Upcroft. 1997. Lethal *Giardia* from a wild-caught sulphur-crested cockatoo (*Cacatua galerita*) established in vitro chronically infects mice. Parasitology 114:407-412.

- U.S.D.A., A.P.H.I.S., ADC. 1994. Animal Damage Control Program. Final Environmental Impact Statement. 3 Volumes. Washington, D.C.
- U.S.D.A., A.P.H.I.S., Veterinary Services. 1993. Fact Sheet: Avian influenza. 2 p.
- U.S.D.A., A.P.H.I.S., W.S. 1998. Canada goose. Leaflet. USDA-APHIS-Wildlife Services. Moseley, Virginia. 5 p.
- U.S.D.I., Fish and Wildlife Service. 1992. Biological opinion for USDA-APHIS-Animal Damage Control Program. Formal Consultation. U.S.D.I., Fish and Wildlife Service, Washington, D. C. 69 p.
- U.S.D.I., Fish and Wildlife Service and U. S. Dept. of Commerce, Bureau of the Census. 1996. National Survey of fishing, hunting, and wildlife -associated recreation: Virginia. 47 p.
- U.S.D.I., Fish and Wildlife Service, Office of Environmental Policy and Compliance. 1997. Natural Resource damage assessment Type A Model/Coastal and Marine Environments Documentation. Vol. 1. 21 p.
- U.S.D.I., Fish and Wildlife Service. 1998. Migratory Bird Special Canada Goose Permit; Proposed Rule. Federal Register, March 31, 1998. 9p.
- U.S.D.I., Fish and Wildlife Service. 1998. Environmental Assessment: Permits for the control and management of injurious resident Canada geese. Office of Migratory Bird Management. Washington, D.C. 92 p.
- U.S. Fish and Wildlife Service. no date. Caution: feeding waterfowl may be harmful. Leaflet. 1 p.
- Virginia Department of Game and Inland Fisheries. no date. Duck viral enteritis. Leaflet. 1 p.
- Virginia Department of Health. 1995. Cryptosporidium: Fact Sheet. Pub. No. FS-DWSE-95-1. Richmond, VA. 3 p.
- Warner, R. E. and D. P. Philipp. 1988. Genetic management of North American pheasants. Pages 199 - 212 In Pheasants: symptoms of wildlife problems on agricultural lands. D. L. Hallet, W. R. Edwards, and G. V. Burger, eds. North Central Section of the Wildlife Society. Bloomington, IN. 345 p.
- Wildlife Society, The. 1990. Conservation policies of the Wildlife Society. The Wildlife Society. Wash., D.C. 20 p.
- Werblow, S. 1997. Know your watershed. Pages 15 - 16 in CTIC Partners. Nov./Dec.
- Wobeser, G. and C. J. Brand. 1982. Chlamydiosis in 2 biologists investigating disease occurrences in wild waterfowl. Wildl. Soc. Bull. 10:170-172
- Woronecki, P. P., R. A. Dolbeer, and T. W. Seamans. 1990. Use of alpha-chloralose to remove waterfowl from nuisance and damage situations. Verteb. Pest. Conf. 14:343-349
- Woronecki, P. P., R. A. Dolbeer, and T. W. Seamans. 1992. Alpha-chloralose efficacy in capturing nuisance waterfowl and pigeons and current status of FDA registration. Verteb. Pest. Conf. 15:72-78
- Wywialowski, A. P. 1991. Implications of the animal rights movement for wildlife damage management. Proceed. of the Great Plains Conf. 10:28-32
- Zielske, C. M., E. D. Michael, J. I. Cromer. 1993. Population dynamics and harvest of Canada geese in West Virginia. Northeast Wildl. 50:111-117

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APPENDIX I: METHODS POTENTIALLY AVAILABLE FOR MANAGEMENT OF RESIDENT CANADA GOOSE AND URBAN DUCK DAMAGE IN VIRGINIA

The most effective approach to resolving wildlife damage problems is to integrate the use of several methods, either simultaneously or sequentially. Integrated wildlife damage management (IWDM) should integrate and apply practical methods of prevention and control to reduce damage by wildlife while minimizing harmful effects of control measures on humans, other species, and the environment. IWDM may incorporate resource management, physical exclusion, wildlife management, or any combination of these, depending on the characteristics of specific damage problems.

In selecting control techniques for specific damage situations, consideration is given to the responsible species and the magnitude, geographic extent, duration and frequency, and likelihood of wildlife damage. Consideration is also given to the status of target and potential nontarget species, local environmental conditions and impacts, social and legal aspects, and relative costs of control options. The cost of control may sometimes be a secondary concern because of the overriding environmental, legal, and animal welfare considerations. These factors are evaluated in formulating control strategies that incorporate the application of one or more techniques.

A variety of methods are potentially available to the Wildlife Services program in Virginia relative to management of resident Canada goose and urban/suburban duck damage. Wildlife Services develops and recommends or implements IWDM strategies based on resource management, physical exclusion and wildlife management approaches. Within each approach there may be available a number of specific methods or tactics. Selection of the appropriate approach and method is the result of the WS decision-making process outlined in Section 5.4.1.3 of this EA and Chapter 2 of the Animal Damage Control Final Environmental Impact Statement (U.S. Dept. Agri. 1994).

Various Federal, State, and local statutes and regulations as well as WS directives govern WS use of control tools and substances. The following methods and materials are recommended or used in technical assistance and direct control efforts of the WS program in Virginia.

A. RESOURCE MANAGEMENT

Resource management includes a variety of practices that may be used by resource owners to reduce the potential for wildlife damage. Implementation of these practices is appropriate when the potential for damage can be reduced without significantly increasing a resource owner's costs or diminishing his/her ability to manage resources pursuant to his goals. Resource management recommendations are made through WS technical assistance efforts.

1. Alter Habitat. Habitat alteration through vegetative plantings or architectural designs may help avoid goose and duck damages. Unpalatable vegetation could make an area more unattractive to these waterfowl and dense vegetation barriers around lakes and other water bodies could discourage movement of these species to/from adjacent lawns, parks, and other areas (Conover and Kania 1991). For example, Canada geese are reported to not eat pachysandra and English Ivy (Conover 1991 and 1992). The use of such plantings would vary among resource owners and professional gardeners dependent upon their particular horticultural goals. The effectiveness of vegetative barriers is variable. Canada geese or mallard ducks are known to repeatedly walk through dense vegetation to reach ponds and short grassy fields in northern Virginia. Also, urban ducks nest in dense grass, forbes, and shrub vegetation. Canada geese nest in dense grass and forbes and graze seed heads from mature grass.

Removal of water bodies would likely reduce attractiveness of an area to waterfowl. Urban/suburban Canada geese in Virginia tend to feed near bodies of water with a distant view over short grass (Conover and Kania 1991). However, draining/removal of water bodies is considered unreasonable and scenically unacceptable by some people, ineffective at moving urban ducks when alternative water is available nearby, and may be detrimental to protection of the Chesapeake Bay since bodies of water, especially man-made

ponds, would be unavailable to filter storm water runoff (Chesapeake Bay Preservation Act, Code of Virginia, Section 10.1-2100; Chesapeake Bay Local Assistance Board, Virginia Regulation 173-02-01; and Storm Water Management Act, Code of Virginia, Section 10.1-603.1).

The Governor of Virginia committed to no net loss of wetlands and to achieve a net gain of wetlands when he signed the Chesapeake Bay Wetlands Policy, Directive 97-2, on October 30, 1997. The draining of wetlands to eliminate Canada goose habitat could be in conflict with this State policy. The draining of wetlands and retention ponds to eliminate resident Canada goose habitat would likely require a Clean Water Act, Section 404 Permit from the Army Corps of Engineers. A Virginia Water Protection Permit might also be required from the Virginia DEQ relevant to Virginia's compliance with section 401 of the Federal Clean Water Act. The issuance of these permits could be contingent upon costly efforts by resource owners to mitigate the loss of the wetlands. According to T. Harmon, DEQ, these costs could range from \$35,000 to \$125,000 per acre.

2. Modify Human Behavior. WS may recommend alteration of human behavior such as the elimination of feeding of waterfowl that occurs at public areas or residential properties. Artificial feeding by people often attracts waterfowl into areas not normally good waterfowl habitat and may sustain more waterfowl in an area than could be supported on natural food supplies. This overabundance may exacerbate property damage, threaten human health or safety, and threaten the health of the waterfowl. Artificial feeding results in waterfowl dependency on people for food, increased human-wildlife conflicts, and the spread of disease such as duck viral enteritis (FWS, undated; VDGIF, undated) and botulism (G. Costanzo and D. Lovelace, VDGIF, pers. commun.). Local ordinances prohibiting feeding of waterfowl may reduce the extent of this human behavior but is unlikely to eliminate it unless strictly enforced. It is difficult to enforce no-feeding regulations and to effectively educate all people concerning the potential liabilities of feeding waterfowl.

3. Alter Aircraft Flight Patterns. In cases where the presence of waterfowl at airports results in threats to air traveler safety and when such problems cannot be resolved by other means, the alteration of aircraft flight patterns or schedules may be recommended. However, altering operations at airports to decrease the potential for hazards is not feasible unless an emergency situation exists. Otherwise, the expense of interrupted flights and the limitations of existing facilities make this practice prohibitive.

4. Create Alternative Habitat. The creation of alternative habitat may have limited applicability in "luring" resident Canada geese or urban ducks from areas where their presence conflicts with human activities, or in providing habitat where waterfowl may be relocated. Lure crops may be planted to temporarily attract waterfowl away from more valuable resources (i.e. crops, lawns). This method is largely ineffective for urban resident Canada geese since food (turf) resources are readily available. Additionally, lure crops reduce damage for only short time periods (Fairaizl and Pfeifer 1988) and damage by resident Canada geese and mallard ducks is generally continuous. The resource owner is limited in implementing this method contingent upon his/her ownership of, or otherwise ability to influence management of, property removed from the problem area. Additionally, unless the original waterfowl-human conflict is resolved, creation of additional waterfowl habitat is likely to increase the potential for conflicts. See Wildlife Management (Relocation).

5. Remove Decoy Waterfowl. The removal of domestic ducks (Peking, Muscovy, domestic mallard) may reduce the attractiveness of areas to other ducks and Canada geese as birds learn to locate food resources by watching behavior of other birds (Rabenhold 1987 and Avery 1994). Resource owners may be reluctant to remove some or all such decoy birds because of their enjoyment of the ducks' presence.

B. PHYSICAL EXCLUSION

Physical exclusion methods restrict the access of wildlife to resources. These methods provide a means of appropriate and effective prevention of resident Canada goose and urban/suburban duck damage in many situations. Physical exclusion methods may be used or recommended by WS.

1. Wire Grids. Canada geese may be excluded from ponds using overhead wire grids (Fairaizl 1992, Lowney 1993). Overhead wire grids have been demonstrated to be most applicable on ponds \leq two acres in size. Wire grids may be considered unsightly or scenically unnatural by some people and are generally ineffective at excluding mallard ducks because of the ability of mallards and other dabbling ducks to fly between the wires. Wire grids render a pond unusable for boating, swimming, fishing, and some other recreational activities. Installation costs include approximately \$1,000 per surface acre for materials. The expense of maintaining wire grids may be burdensome for some people.

2. Perimeter Fencing. Fencing of various types (i.e. permanent, temporary, plastic, wire, electric) may be effective in limiting movement of goose and duck access to parks, lawns and other grassy areas used for feeding and loafing. Perimeter fencing, which is a partial exclusion method, reduced resident Canada goose abundance from 100 to 30 birds at one Prince William County location in 1996 during the pre-nesting period (Lowney, USDA-APHIS-WS, unpublished data). This method is most effective during the summer when waterfowl are molting and therefore flightless. Fencing may be considered unsightly or scenically unnatural by some people and may have limited effectiveness in excluding free-flying waterfowl. Installation/maintenance costs may be a financial burden for some people.

3. Floating Ball Blanket. Canada geese and ducks may be excluded from ponds using a floating ball blanket consisting of plastic ball's approximately five inches in diameter covering the surface of a pond. A ball blanket renders a pond unusable for boating, swimming, fishing, and most other recreational activities. This method is very expensive, costing approximately \$131,000 per surface acre of water to implement.

C. WILDLIFE MANAGEMENT

The objectives of wildlife management are to alter the behavior and/or reduce numbers of target animals to eliminate or reduce the potential for damage. Wildlife management methods may be used or recommended by WS.

1. Frightening Methods. The use of auditory or visual stimuli may be effective in frightening waterfowl from some areas. The success of frightening methods depends on animals' fear of, and subsequent aversion to, offensive stimuli. Once animals become habituated to a stimulus, they often resume their damaging activities. Persistent effort is usually required to consistently apply frightening techniques and to vary them sufficiently to prolong their effectiveness. Over time, some animals learn to ignore commonly used scare tactics. In many situations animals frightened from one location become a problem at another. Some frightening devices may have negative effects on nontarget wildlife. The use of some frightening devices/techniques in urban/suburban environments may be considered aesthetically displeasing or a nuisance by some persons. Some methods potentially available to the resource owner or WS include guarding animals, distress calls, pyrotechnics, propane cannons, flags, and reflective tape.

a. Guarding animals may be used to frighten resident Canada geese and urban ducks from areas where damage is occurring. Dogs can have limited effectiveness at harassing geese and urban mallard ducks and keeping them off turf and beaches (Conover and Chasko 1985). This technique appears most effective in areas with no water bodies or with single water bodies less than two acres in size as waterfowl must go elsewhere to seek refuge (Swift 1998). Harassment from one property may move geese or ducks to adjacent properties and result in damages there (Shen 1998). Swift (1998) used trained border collies with a handler an average of five times per day to reduce goose abundance but found the number of geese returned to pre-treatment numbers when harassment efforts ceased. Border collies trained to harass geese are commercially available for approximately \$2,000 to \$4,000 per dog.

Mute swans should not be used to harass geese and swans. Swans are ineffective at preventing Canada geese or other waterfowl from using or nesting on ponds (Conover and Kania 1994 and W. Sladen, Airlie Environmental Center, pers. commun.), can be aggressive towards humans and other waterfowl (Conover and Kania 1994, Chasko 1986), and can have undesirable effects on native aquatic vegetation (Allin et al. 1987, Chasko 1986). Mute swans are an exotic species to North America. Executive Order 11987 signed May 24, 1977 by President Carter, directs federal agencies to encourage states, local governments, and private citizens to prevent the introduction of exotic species into the environment. The VDGIF has requested that WS not recommend mute swans for goose/waterfowl management purposes.

b. Distress calls have been found ineffective at causing migratory and resident geese to abandon a pond (Aguilera et al. 1991). Mott and Timbrook (1988) reported distress calls as effective at repelling resident Canada geese 100 meters from the distress unit. Effectiveness was enhanced when integrated with pyrotechnics. Mott and Timbrook doubted the effectiveness of the distress call/pyrotechnics harassment methods if the geese lacked alternative sites to loaf and feed. Distress calls for Canada geese are not commercially available. The Av-alarm, a commercially available electronic sound generating device, is ineffective at repelling migrant Canada geese (Heinrich and Craven 1990). Electronic sound generating devices are ineffective at repelling wild mallard ducks (M. Baldy, Washington National Airport, pers. commun.)

c. Pyrotechnics (screamer shells, bird bombs, and 12 gauge cracker shells) have been used to repel many species of birds (Booth 1994). Aguilera et al. (1991) found 15mm screamer shells effective at reducing resident and migrant Canada goose abundance in Colorado. Mott and Timbrook (1988) found a 96% reduction in resident Canada goose abundance when 15mm screamer shells were used with distress calls in Tennessee. Aguilera et al. (1991) and Mott and Timbrook (1988) doubted the efficacy of harassment and believed the problem was redistributed to other areas of the city/lake. Fairaizl (1992), and Conomy et al. (1998) found effectiveness of pyrotechnics highly variable among different flocks of Canada geese and species of waterfowl. Some flocks in urban areas required continuous day-long harassment with frequent discharges of pyrotechnics to move Canada geese. The geese usually returned within hours. A minority of resident Canada goose flocks in Virginia show no response to pyrotechnics (Fairaizl 1992). Some flocks of Canada geese in Virginia have shown quick response to pyrotechnics during winter months suggesting migrant geese made up some or all of the flock (Fairaizl 1992). Shultz et al. (1988) reported fidelity of local (resident) Canada geese to feeding and loafing areas is strong, even when heavy hunting pressure is ongoing. Mott and Timbrook (1988) concluded that the efficacy of harassment with pyrotechnics is partially dependent on availability of alternative loafing and feeding areas. Urban ducks are largely unresponsive to pyrotechnics.

Discharge of pyrotechnics is inappropriate and prohibited in some urban/suburban areas. Pyrotechnic projectiles can start fires, ricochet off buildings, pose traffic hazards, cause some dogs to bark incessantly, and injure and annoy people. Pyrotechnics may cause fear or alarm in urban/suburban areas as the sound of discharge sometimes resembles gunfire.

d. Propane cannons operate on propane gas and are designed to produce loud explosions at controllable intervals. They are strategically located in areas of high waterfowl use. Propane cannons are generally inappropriate for use in urban/suburban areas due to the repeated loud

explosions which many people consider an unacceptable nuisance. Additionally, resident Canada geese may habituate to the noise in less than three weeks.

e. Reflective tape has been used successfully to repel some bird species from crops when spaced at 3 or 5 meter intervals (Bruggers et al. 1986, Dolbeer et al. 1986). Other studies have shown reflective tape ineffective (Tobin et al. 1988, Bruggers et al. 1986, Dolbeer et al. 1986, Conover and Dolbeer 1989). L. Terry (USDA-APHIS-WS, pers. commun.) reported mylar tape being used effectively to repel migrant Canada geese from winter cereal grain crops. The literature is vacant on the effects of reflective tape on waterfowl. Anecdotal accounts indicate reflective tape may be effective at guiding resident Canada geese to alternative grazing areas when the tape is strung as a single line fence along a shoreline.

Reflective tape may tear and blow into the lake, pond, or adjacent property which would require litter patrols to pick up scattered tape. Additionally, the tape will require maintenance and replacement.

f. Flags may have limited effectiveness in frightening resident Canada geese. Mason et al. (1993) and Mason and Clark (1994) have shown white and black plastic flags to be effective at repelling snow geese from pastures when alternative grazing areas were available. Anecdotal reports indicate black flagging may be effective at repelling migrant Canada geese. Mylar flagging has been reported effective at reducing migrant Canada goose damage to crops (Heinrick and Craven 1990). Effects of flagging on resident geese in urban/suburban areas is unknown.

2. Chemical Repellents. Methyl anthranilate, a grape flavor food additive approved by the FDA for human consumption, is one of two chemical formulations registered with the EPA as a Canada goose taste repellent. The methyl anthranilate product, Rejex-It™ has repelled Canada geese from grazing turf for four days (Cummings et al. 1995). However, Belant et al. (1996) found the Rejex-It™ ineffective as a grazing repellent when applied at the label rate of 22.6 kg/ha and also when applied at triple the label rate at 67.8 kg/ha. Moderate to heavy rain or daily watering and/or mowing render Rejex-It™ ineffective.

Rejex-It™ has been reported effective during the fall (September through November) when geese are more prone to move to alternative feeding areas. Most property owners who have commented to WS about Rejex-It claim it was ineffective, effective initially but the geese became used to it, or did not fit into their grass cutting or watering schedule. Rejex-It™ was ineffective at stopping summer grazing damage by urban mallard ducks at a shopping mall in Henrico County, Virginia during 1996 and an office park in Fairfax County, Virginia during 1997. The cost of 2.5 gallons of Rejex-It™ to treat one acre is approximately \$137.00. The size of the areas to be treated, chemical cost, watering and grass cutting schedules, and relative effectiveness may be unfavorable to the widespread use of Rejex-It™ on golf courses and some office parks.

Rejex-It™ has had variable effectiveness in repelling Canada geese when applied experimentally as a fog by the use of thermal foggers and ultra low volume (ULV) mosquito foggers. Thermal foggers have caught fire because of the combustibility of Rejex-It™ (D. Wilda, USDA-APHIS-WS, pers. commun.). ULV mosquito foggers have been advocated by the manufacturer of Rejex-It™ because of this safety issue (P. Vogt, RJ Advantage, Inc., letter to M. Lowney, September 18, 1998). However, RJ Advantage recommends the use of thermal and ULV foggers when applying Rejex-It (leaflet, RJ Advantage, June 1998). Other distributors of Rejex-It recommend the use of thermal foggers over ULV foggers (J. Ling, Flock Fighters USA, pers. commun. to C. Fox, WS). The fog may repel other birds including desirable species and leaves a strong grape odor which may persist for several days after application. No effective repellents are registered for turf application to control duck damage.

The other chemical formulation registered with EPA to repel geese is Flight Control. The active ingredient

is anthraquinone. Little published data is available about the efficacy of this product.

3. Relocation. The capture of geese and ducks and their relocation to another area may reduce or eliminate damage in the capture area. Resident Canada geese and urban ducks causing conflicts may be captured with panel traps during the summer molt when the birds are flightless, or at other times with rocket nets, swim-in traps, decoy traps, dip nets, and by hand. The molt is the loss of flight in waterfowl due to the annual replacement of primary and secondary wing flight feathers. The molt for resident Canada geese occurs approximately from June 18 through July 12 and flightlessness of a portion of the flock can occur approximately one week pre-and two weeks post-molt due to the asynchronous molting by individual birds. The molt for ducks is approximately late July through early August. The immobilizing drug, alpha-chloralose (FDA Investigational New Animal Drug Registration 6602) may be used only by WS personnel who have been trained and certified in its use. A permit from the FWS would be required for any non-federal personnel to capture waterfowl.

Relocation of resident Canada geese and urban ducks in the Commonwealth of Virginia is opposed by the VDGIF because of the likelihood of moving the problem or conflict elsewhere. Wildlife management agencies in other states are generally unwilling to accept resident Canada geese for relocation in their respective states because of associated conflicts and problems. Relocated waterfowl have caused epizootics and avian disease outbreaks (e.g., duck virus enteritis) resulting in the death of hundreds of waterfowl annually (G. Costanzo, VDGIF, pers. commun.). Some relocated geese may return to their capture sites. Cooper and Keefe (1997) found 42 - 80% of adult Canada geese relocated from Minnesota to Oklahoma returned to the capture area and Fairaizl (1992) found 19% of juveniles relocated within Nevada returned to the capture area.

4. Contraception. No contraceptive drugs are registered with the FDA for use in managing Canada geese or other waterfowl. Canada geese have been successfully vasectomized to reduce recruitment into future populations, however this may be effective only if the male remains mated and it only affects reproduction from that male's female mate. The ability to identify breeding pairs for isolation and to capture a male goose for vasectomization becomes increasingly difficult as the number of geese increase (Converse and Kennelly 1994). Contraception or sterilization of resident Canada geese would not, in the short term, reduce damages caused by their overabundance. Reproduction control in large numbers of birds over an extended period of time would be required in order for mortalities, from various causes, to reduce the population.

6. Population Reduction. A permit from the FWS is required of persons, businesses, and local and state government agencies authorizing them to capture or kill depredating waterfowl. This includes all the methods discussed below. The FWS recognizes WS as having the authority (via Animal Damage Control Act of 1931) and expertise in alleviating wildlife damage and conflicts, and therefore, requires written reports, on a case-by-case basis, from WS recommending the taking of migratory birds, their eggs (except Canada goose eggs) or nests before such permits will be issued. Federal agencies, while exempt from permit requirements of the MBTA, must also obtain written recommendations from WS and a letter of authorization from VDGIF to take migratory birds, nests, or eggs.

a. **Hunting** from September 1 through March 20 may reduce resident Canada goose populations in some areas but would likely have limited effectiveness in reducing urban mallard duck populations. Legal hunting alone will not control abundance of resident Canada geese in urban areas (FWS 1998). Zielske et al. (1993) believed legal hunting would not control Canada goose populations where there is limited interest in legally hunting resident Canada geese. Also,

discharge of firearms, and therefore legal hunting, is impractical or prohibited in most urban/suburban areas. Populations of urban mallard ducks are rarely exposed to legal hunting mortality. Legal hunting reinforces harassment programs (Kadlec 1968). A State hunting license, Harvest Information Program number, and federal Migratory Bird Conservation Stamp (Duck Stamp) is required to legally hunt Canada geese and mallard ducks in Virginia.

b. Shooting to supplement harassment can sometimes enhance effectiveness of harassment techniques and can help prevent waterfowl habituation to an area (Kadlec 1968). Shooting may be impractical and/or prohibited in some urban/suburban locations because of safety concerns. Permits from local police or Animal Control would sometimes be required to discharge a firearm in city limits. The shooting of urban ducks to supplement harassment would be ineffective at some locations where flightless ducks are causing conflicts. Harassment and supplemental shooting could be expected to temporarily alleviate damage at local sites except during nesting when adult Canada geese and urban ducks are unwilling to abandon their nesting locations.

c. Nest/egg destruction may be used to prevent or minimize local population increases of Canada geese and ducks. Egg addling, oiling, freezing, puncturing is effective at reducing recruitment into the local population (Christens et al. 1995, Cummings et al. 1997). Nests may be removed or destroyed to disperse overly aggressive Canada geese, however this aggressiveness may intimidate some people and result in some eggs/nests not being treated/destroyed. Canada geese having their eggs oiled in successive years may learn to nest away from the water making it more time consuming to find nests (R. Thomas, VDACS, pers. commun.).

Eggs may legally be oiled only with corn oil or other natural food oils which are exempted from the data requirements to register these products as pesticides (Federal Register Notice, March 6, 1996). Destruction of urban duck eggs may be beneficial towards reducing abundance, however, locating nests is difficult since ducks nest in dense vegetation usually away from water. Egg/nest destruction of resident Canada geese and urban ducks would not, in the short term, reduce damages caused by their overabundance. Egg/nest destruction over an extended period of time would be required in order for mortalities, from various causes, to reduce the populations.

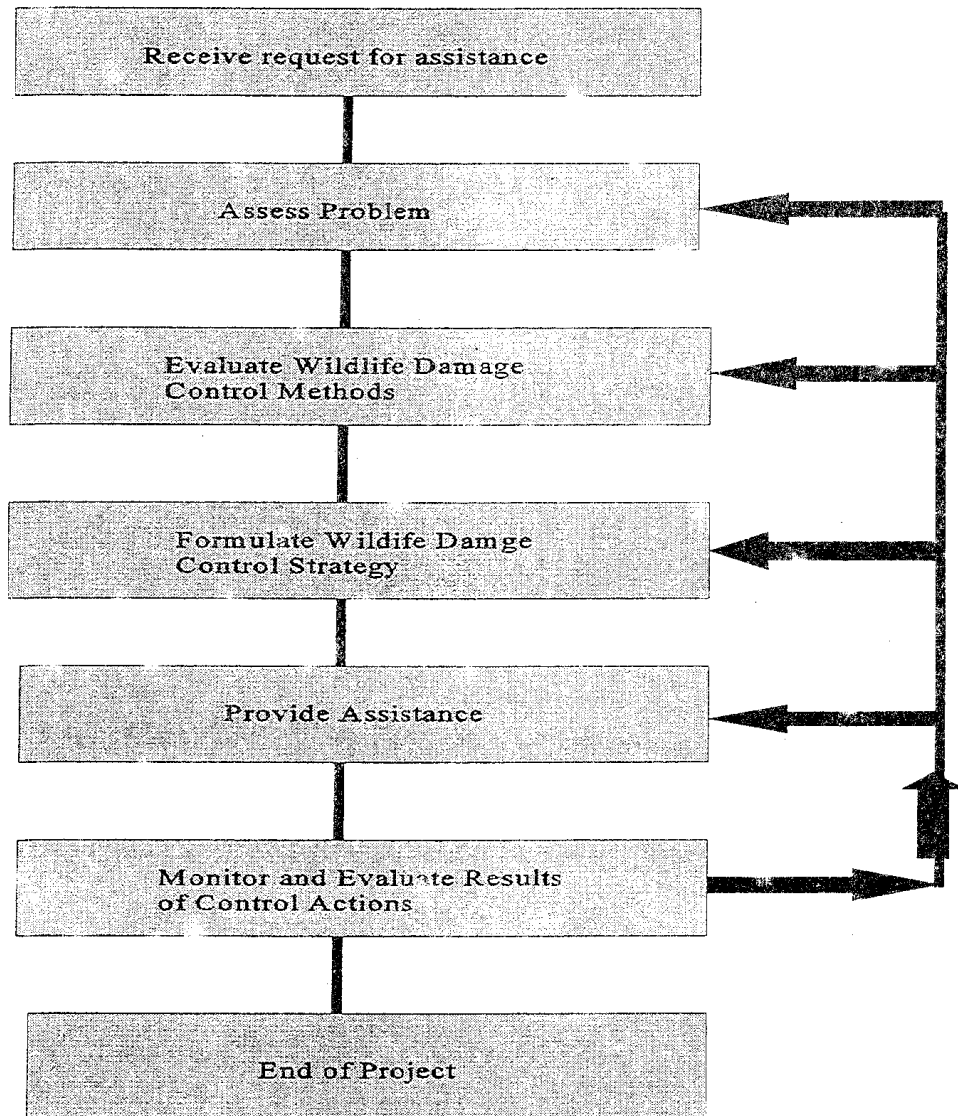
d. Capture and euthanasia may be used to reduce local populations of resident Canada geese and urban ducks. Resident Canada geese and urban ducks causing conflicts may be captured with panel traps during the summer molt when the birds are flightless, or at other times with rocket nets, swim-in traps, decoy traps, dip nets, and by hand. The molt is the loss of flight in waterfowl due to the annual replacement of primary and secondary wing flight feathers. The molt for resident Canada geese occurs approximately from June 18 through July 12 and flightlessness of a portion of the flock can occur approximately one week pre-and two weeks post-molt due to the asynchronous molting by individual birds. The molt for ducks is approximately late July through early August.

Migrant Canada geese are present from late September through the middle of March. The FWS and the VDGIF do not want migrant Canada geese captured. Therefore, capture and euthanasia of resident Canada geese is restricted to the period March 21 to August 31. Resident Canada geese captured from March 21 through August 31 may be processed for human consumption and donated to charities. Urban ducks may be captured any time during the year and processed for human consumption and donated to charities.

The immobilizing drug, alpha chloralose, may be used only by WS personnel to capture waterfowl. Pursuant to FDA restrictions, waterfowl captured with alpha chloralose for subsequent euthanasia must be killed and buried or incinerated, or be held alive for at least 30 days, at which time the birds may be killed and processed for human consumption.

f. Chemical toxicants have been developed to control wildlife damage and are widely used because of their efficiency. However, there are no toxic chemicals registered with the EPA for use in managing Canada goose or duck damage.

APPENDIX II: WILDLIFE SERVICES DECISION MOEL



APPENDIX III: CONSULTATIONS

The consultation process involves consulting with affected Federal and State agencies and with all parties affected by or who have shown interest in the action. The following individuals were consulted with because they work with an affected government agency, are an affected person, or expressed an interest in the proposed action.

Bob Thomas	VA Dept. of Agriculture and Consumer Services
Joe May	VA Dept. of Agriculture and Consumer Services
Phil Eggborn	VA Dept. of Agriculture and Consumer Services
Frank Fulgham	VA Dept. of Agriculture and Consumer Services
Dr. Joe Garvin	VA Dept. Of Agriculture and Consumer Services
Gary Costanzo	VA Dept. of Game and Inland Fisheries
Bob Duncan	VA Dept. of Game and Inland Fisheries
Bob Ellis	VA Dept. of Game and Inland Fisheries
Phil West	VA Dept. of Game and Inland Fisheries
Brad Howard	VA Dept. of Game and Inland Fisheries
Gary Hagey	VA Dept. of Health
Dr. Tripathi	VA Dept. of Health
Michele Monti	VA Dept. of Health
Dr. Elizabeth Barrett	VA Dept. of Health
Tracy Harmon	VA Dept. Of Environmental Quality
Harold Jones	Army Corps of Engineers
Don Patterson	U.S. Fish and Wildlife Service
Dan Hurt	U.S. Fish and Wildlife Service
Al Hundley	U.S. Fish and Wildlife Service
Jim Parkhurst	Dept. of Fisheries and Wildlife, Virginia Polytechnic Institute & State University
John Zuiker	Fairfax County Park Authority
Jack Robert	Northern Virginia Regional Park Authority
Mike Lee	Fairfax County Animal Control
Bill Sladen	Environmental Studies, Swan Research Program
Kevin Richards	Environmental Studies, Swan Research Program
Laura Bigler	Cornell University
Dana Pitts	Washington Dulles International Airport
Paul Fantinato	Washington Ronald Reagan National Airport

Ralph Wilson	Colonial Williamsburg Foundation
Amy Pratt	Upper Occoquan Sewage Authority
John Coe	Richmond Audubon Society
Bonnie Ellen	VA Foundation of Humane Societies
Gregory Otto	Golden Horseshoe Golf Course
Glenn Bishop	Virginia Power
Earl Hodnett	No. Virginia Regional Park Authority
Paul Gordon	Lake Barcroft Watershed Improvement District
Anne Hocker	Loudoun Wildlife Conservancy
Theresa Duffy	VA Department of Conservation and Recreation
Chuck Thompson	Ford's Colony Country Club
Betty Staples	Richmond, VA
Deanna Higgenson	U.S. Navy
Francine Blend	U.S. Navy
Captain Craig Campbell	U.S. Air Force
Lt. Col. Steve Miller	U.S. Air Force
Captain Gary Alexander	U.S. Air Force
Captain David Hines	U.S. Air Force
John Grandy	Humane Society of the United States
John Hadidian	Humane Society of the United States
Nancy Perry	Humane Society of the United States
Patricia Klein	Humane Society of the United States
Robin McClary	Citizens for the Preservation of Wildlife
Chris Miller	Citizens for the Preservation of Wildlife
Hiedi Jacobs	Citizens for the Preservation of Wildlife
Stephanie Boyles	People for the Ethical Treatment of Animals
Jane Lanham	The Canada Goose Group
Pete Petersan	Fund for Animals
Roger Ethier	Wildlife Preservation and Management Council
Mary Zoeter	Action for Animals Network